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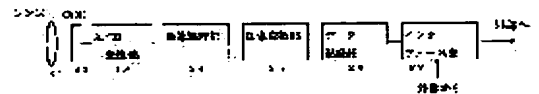
(72)Inventor : TAKAHASHI KENJI

## (54) IMAGE PROCESSING UNIT, ITS CONTROL METHOD, IMAGE PROCESSING SYSTEM, OUTPUT DEVICE AND STORAGE MEDIUM

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an image processing unit, its control method, an image processing system and an output device where a total throughput is improved without increasing the cost.

**SOLUTION:** In a image processing system composed by connecting a digital camera and a printer, the digital camera communicates mutually with the printer by using an interface part 27 at the side of the digital camera and picture elements capable of recording by one scanning of a recording head of the printer are received via the interface section 27. Based on the number of the received picture elements, image data inputted to the digital camera are divided and compressed by an image conversion part 25.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The image processing system which is the image processing system which processes to the inputted image data and outputs to an output unit, and is characterized by to have the means of communications which communicates to mutual [ said / output unit and mutual ], a receiving means receive the output unit information which shows the output unit of the image data of said output unit through said means of communications from this output unit, and a compression means divide and compress said inputted image data based on the output unit information which received with said receiving means.

[Claim 2] Said compression means is an image processing system according to claim 1 characterized by having a storage means to memorize the compressed image data.

[Claim 3] The image processing system according to claim 1 characterized by transmitting the image data memorized by said storage means according to output setting out of said output unit and said output unit to this output unit through said means of communications.

[Claim 4] Said output setting out is an image processing system according to claim 3 characterized by including setting out about amplification/reduction percentage of the image outputted at least, and image size.

[Claim 5] Said compression means is an image processing system according to claim 1 characterized by dividing said inputted image data per predetermined, and compressing it.

[Claim 6] Said predetermined unit is an image processing system according to claim 5 characterized by being the number of pixels of the multiple of 8.

[Claim 7] Said compression means is an image processing system according to claim 6 characterized by dividing and compressing the this inputted image data for every number of pixels of said multiple of 8 to either [ at least ] the pixel direction of said inputted image data, or the direction of a line.

[Claim 8] Said means of communications is an image processing system according to claim 1 characterized by being an IEEE1394 serial bus.

[Claim 9] The control approach of the image processing system characterized by to have the receiving process which receives the output unit information which it is the control approach of the image processing system which processes to the inputted image data and is outputted to an output unit, and shows the output unit of the image data of said output unit from this output unit, and the pressing operation which divide and compress said inputted image data based on the output unit information received at said receiving process.

[Claim 10] Said pressing operation is the control approach of the image processing system according to claim 9 characterized by having the storage process which memorizes the compressed image data to a storage.

[Claim 11] The control approach of the image processing system according to claim 9 characterized by transmitting the image data memorized by said storage according to output setting out of said output unit and said output unit to this output unit.

[Claim 12] Said output setting out is the control approach of the image processing system according to claim 11 characterized by including setting out about amplification/reduction percentage of the image outputted at least, and image size.

[Claim 13] Said pressing operation is the control approach of the image processing system

according to claim 9 characterized by dividing said inputted image data per predetermined, and compressing it.

[Claim 14] Said predetermined unit is the control approach of the image processing system according to claim 13 characterized by being the number of pixels of the multiple of 8.

[Claim 15] Said pressing operation is the control approach of the image processing system according to claim 14 characterized by dividing and compressing the this inputted image data for every number of pixels of said multiple of 8 to either [ at least ] the pixel direction of said inputted image data, or the direction of a line.

[Claim 16] It is the image processing system which has the image processing system which processes to the inputted image data, and the output unit which outputs the image based on the image data processed with this image processing system. The means of communications which communicates mutually with said image processing system and said output unit, and said means of communications are minded. A 1st transfer means to transmit the output unit information which shows the output unit of the image data of said output unit to said image processing system, A compression means to divide and compress said inputted image data based on the output unit information notified with said advice means, The image processing system by which it is having-through said means of communications-2nd transfer means to transmit image data compressed with said compression means according to output setting out of said output unit and said output unit to this output unit characterized.

[Claim 17] Said output setting out is an image processing system according to claim 16 characterized by including setting out about amplification/reduction percentage of the image outputted at least, and image size.

[Claim 18] Said compression means is an image processing system according to claim 16 characterized by having a storage means to memorize the compressed image data.

[Claim 19] Said compression means is an image processing system according to claim 16 characterized by dividing said inputted image data per predetermined, and compressing it.

[Claim 20] Said means of communications is an image processing system according to claim 16 characterized by being an IEEE1394 serial bus.

[Claim 21] The output unit which is the output unit which outputs the image based on the image data inputted from the image processing system, and is characterized by to have the means of communications which communicates to mutual [ said / image processing system and mutual ], a transmitting means transmit the output unit information which shows the output unit of the image data of the output unit concerned to said image processing system through said means of communications, and a receiving means receive said output unit and the image data according to output setting out of the output unit concerned from said image processing system through said means of communications.

[Claim 22] Said output setting out is an output unit according to claim 21 characterized by including setting out about amplification/reduction percentage of the image outputted at least, and image size.

[Claim 23] The image data inputted from said image processing system is an output unit according to claim 21 characterized by having further a thawing means to be the compressed image data and to thaw said compressed image data.

[Claim 24] It is the output unit according to claim 21 characterized by to determine the number of image data which was equipped with a comparison means compare with said output unit information the information which the image data inputted from said image processing system is image data compressed per predetermined, and said receiving means receives the information which shows said predetermined unit from said image processing system, and shows this predetermined unit, and was compressed in said predetermined unit corresponding to said output unit based on the comparison result of said comparison means.

[Claim 25] Said means of communications is an output unit according to claim 21 characterized by being an IEEE1394 serial bus.

[Claim 26] The storage which characterizes by to have the program code of the receiving process which receives the output unit information that the program code of control of the image processing system which processes to the inputted image data and outputs to an output unit is stored, and an approach is the storage [ computer ] which can be read and shows the output unit

of the image data of said output unit, from this output unit, and the program code of the pressing operation which divides and compresses said inputted image data based on the output unit information received at said receiving process.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image processing system which processes to the inputted image data and is outputted to an output unit and its control approach, an image processing system, an output unit, and a storage.

[0002]

[Description of the Prior Art] Conventionally, the image data photoed with the digital camera was transmitted with personal \*\*, and the output of image data was performed by the printer connected with the personal computer. However, in order to enable the activity of a digital jar also at the user who is not a personal computer user, direct continuation of a digital camera and a printer is made possible, and the image processing system which can record the image based on image data is developed.

[0003] The storage capacity of the storage for generally memorizing the image data based on the photoed image to a digital camera has a limit. Therefore, in order to enable it to memorize as many image data as possible to the storage, JPEG compression of the image data is carried out, and it memorizes to a storage. In order to perform record (direct print) by the printer by which direct continuation was carried out to the digital camera in such image data by which JPEG compression was carried out, the storage which has the storage capacity for the image amount of data obtained by carrying out JPEG thawing of the image data by which JPEG compression was carried out in a digital camera or a printer is needed. Now, the printer of the image processing system which has realized this direct print does not record a part for the image data plurality of A6 size in the record actuation which records on the record medium of one sheet for A6 size. Therefore, it is realizable if there is a storage (buffer memory) with the memory capacity for image data of A6 size. However, like drawing 1, when recording three images, A, B, and C, on the record medium of A4 size in the scanning direction of the recording head of a printer, [ for example, ] Since the number of pixels recordable by one scan of a recording head is limited, in the scan of the recording head which is the 1st time What is necessary is just to memorize the image data corresponding to the record section of each record medium to buffer memory one by one, as the image data corresponding to the parts of A1, B1, and C1 in drawing 1 was said to buffer memory as the parts of A2 in drawing 1, B-2, and C2 by storage and the scan of the 2nd recording head.

[0004]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional image processing system, although it becomes possible by having the buffer memory for three image data which carried out JPEG thawing of the image data of A, B, and C of A4 size by which JPEG compression was carried out in a digital camera or a printer in order to realize the above records, problems, such as cost, to implementation is difficult for this.

[0005] Moreover, it has the buffer memory for one image data which carried out JPEG thawing of the image data of A4 size by which JPEG compression was carried out in a digital camera or a printer. The image data of A JPEG thawing, the writing to the buffer memory of the image data of inner A1 part of the image data of A, The image data of B JPEG thawing, the writing to the buffer memory of the image data of inner B1 part of the image data of B, JPEG thawing of the image data of C, the writing to the buffer memory of the image data of inner C1 part of the image data of

C, The scan of the 1st recording head, and the image data of A JPEG thawing, the writing to the buffer memory of the image data of inner A2 part of the image data of A, The image data of B JPEG thawing, the writing to the buffer memory of the image data of the inner B-2 part of the image data of B, Although buffer memory can also be saved by performing record, such as JPEG thawing of the image data of C, writing to the buffer memory of the image data of inner C2 part of the image data of C, and a scan of the 2nd recording head Since the count the image data by which JPEG compression was carried out carries out [ a count ] JPEG thawing increases, the problem that a recording rate falls occurs.

[0006] It aims at offering the image processing system which can improve a total throughput and its control approach, an image processing system, an output unit, and a medium, without making this invention in view of the above-mentioned trouble, and raising cost.

[0007]

[Means for Solving the Problem] The image processing system by this invention for solving the above-mentioned object is equipped with the following configurations. That is, it is the image processing system which processes to the inputted image data and outputs to an output unit, and it has the means of communications which communicates to mutual [ said / output unit and mutual ], a receiving means receive the output unit information which shows the output unit of the image data of said output unit from this output unit through said means of communications, and a compression means divide and compress said inputted image data based on the output unit information which received with said receiving means.

[0008] Moreover, said compression means is preferably equipped with a storage means to memorize the compressed image data. Moreover, setting out about amplification of the image which outputs said output setting out at least preferably [ again ] / [ which transmits preferably the image data memorized by said storage means according to output setting out of said output unit and said output unit to this output unit through said means of communications ] reduction percentage, and image size is included.

[0009] Moreover, preferably, said inputted image data is divided per predetermined, and said compression means compresses it. Moreover, said predetermined unit is the number of pixels of the multiple of 8 preferably. Said compression means divides and compresses the this inputted image data for every number of pixels of said multiple of 8 to either [ at least ] the pixel direction of said inputted image data, or the direction of a line.

[0010] Moreover, said means of communications is an IEEE1394 serial bus preferably. The control approach of the image processing system by this invention for attaining the above-mentioned object is the control approach of the image processing system which is equipped with the following configurations, namely, processes them to the inputted image data, and outputs them to an output unit, and it has the receiving process which receives the output unit information which shows the output unit of the image data of said output unit from this output unit, and the pressing operation which divide said inputted image data and compress based on the output unit information received at said receiving process.

[0011] The image processing system by this invention for attaining the above-mentioned object is equipped with the following configurations. Namely, it is the image processing system which has the image processing system which processes to the inputted image data, and the output unit which outputs the image based on the image data processed with this image processing system. The means of communications which communicates mutually with said image processing system and said output unit, and said means of communications are minded. A 1st transfer means to transmit the output unit information which shows the output unit of the image data of said output unit to said image processing system, A compression means to divide and compress said inputted image data based on the output unit information notified with said advice means, It has a 2nd transfer means to transmit the image data compressed with said compression means according to output setting out of said output unit and said output unit to this output unit, through said means of communications.

[0012] The output unit by this invention for attaining the above-mentioned object is equipped with the following configurations. That is, it is the output unit which outputs the image based on the image data inputted from the image processing system, and has the means of communications

which communicates to mutual [ said / image processing system and mutual ], a transmitting means transmit the output unit information which shows the output unit of the image data of the output unit concerned to said image processing system through said means of communications, and a receiving means receive said output unit and the image data according to output setting out of the output unit concerned from said image processing system through said means of communications.

[0013]

[Embodiment of the Invention] Although the following operation gestalten explain the example which used the digital interface (D-I/F) for connection between a digital camera and a printer, in advance of this, IEEE1394 is explained as a representation technique of D-I/F employable with this operation gestalt.

Outline>> of the technique of <<IEEE1394 In order to communicate a video data, audio data, etc. with the appearance of noncommercial digital one VCR and a DVD player, it is real time and the support of the data transfer of high amount of information is needed. In order to transmit such video datas and audio data on real time and to transmit to the digital instrument of downloading to a personal computer (PC) \*\*\*\*, or others, the interface equipped with the required transfer facility in which a high-speed-data transfer is possible is needed. The interface developed from such viewpoints is IEEE1394 -1995 (it is called HighPerformance Serial Bus and a following 1394 serial bus).

[0014] Drawing 11 is drawing showing the example of a configuration of the network system constituted using a 1394 serial bus. This system is equipped with Devices A, B, C, D, E, F, G, and H, and it connects with the twisted-pair cable of a 1394 serial bus, respectively between A-B, between A-C, between B-D, between D-E, between C-F, between C-G, and between C-H. These device A-H is a personal computer, digital VTR, DVD, a digital camera, a hard disk, a monitor, a tuner, etc.

[0015] The connection type between each device enables mixture of a daisy chain method and node multipoint system, and high connection of a degree of freedom is possible for it. Moreover, each device has ID of a proper each one, and when each recognizes each other, it constitutes one network in the range connected by 1394 serial bus. Sequential connection of between each digital instrument is only made with one 1394 serial bus cable, respectively, and each device performs the role of junction and constitutes one network as a whole. Moreover, a 1394 serial bus has a Plug & Play function, and when it connects a cable to a device, it has the function to recognize recognition, a connection situation, etc. of a device automatically.

[0016] Moreover, in a system as shown in drawing 11 , when a certain device is deleted from a network or it is newly added, after performing bus reset automatically and resetting the network configuration till then, a new network is reconstructed. By this function, the configuration of that occasional network can always be set up and recognized.

[0017] Moreover, it has 100/200/400Mbps, a device with the transfer rate of a high order supports a low-ranking transfer rate, and a data transfer rate takes transposition. As data transfer mode, there are Asynchronous transfer mode which transmits asynchronous datas (Asynchronous data: henceforth Async data), such as a control signal, and Isochronous transfer mode which transmits synchronous data (Isochronous data: henceforth Iso data), such as a real time video data and audio data. After this Async data and Iso data transmit the cycle-start packet (CSP) which shows cycle initiation in each cycle (usually 1 cycle 125microsecond), giving priority to an Iso data transfer over Async data, within a cycle, it is intermingled and they are transmitted.

[0018] Drawing 12 is drawing showing the component of a 1394 serial bus. The 1394 serial bus consists of layer (hierarchy) structures as a whole. As shown in drawing 12 , there is a connector port where a connector is connected with the cable of a 1394 serial bus, and the physical layer and the link layer are positioned as hardware on it.

[0019] The hardware section is the part of a substantial interface chip, among those a physical layer performs coding, connector-related control, etc., and a link layer performs packet transfer, control of the cycle time, etc. The transaction layer of the firmware section manages the data which should be transmitted (transaction), and issues the instruction of Read, Write, and Lock. Serial bus management (management layer) is a part which performs management of the

connection situation of each device connected, or ID, and manages a network configuration. Even the above hardware and firmware are the configuration of the 1394 serial bus on parenchyma. [0020] Moreover, the application layer of the software section changes with application software to be used, it is the part which specifies the data which carry on an interface, and the printer protocol, the AVC protocol, etc. are specified. The above is the configuration of a 1394 serial bus. Drawing 13 is drawing showing the address space in a 1394 serial bus. 64 bit addresses of each node proper are surely given to each device (node) connected to the 1394 serial bus. And by storing this address in ROM, while always being able to recognize the node address of oneself's or a partner, the communication link which specified the partner can also be performed. Addressing of a 1394 serial bus is a method according to IEEE1212 specification, 10 bits of the beginning are used for assignment of the number of a bus, and, as for address selection, the following 6 bits are used for assignment of a node ID number. And the remaining 48 bits become the address width of face given to the device, and can use it as an address space of a proper, respectively. In addition, 28 bits of the second half in 48 bits store discernment of each device, the information on assignment of a service condition, etc. as a field of proper data.

[0021] The above is the outline of the technique of a 1394 serial bus. Next, the part of the technique which can be called description of a 1394 serial bus is made to explain to a detail more. Electric specification>> of <<1394 serial bus Drawing 14 is the sectional view of a 1394 serial bus cable. By 1394 serial bus, the power-source line other than six pins, i.e., 2 sets of twisted pair signal lines, is prepared in the interconnection cable. Supply of power is attained at the device which does not have a power source by this, the device which carried out sag by failure. In addition, 8-40V, and a current are specified for the electrical potential difference of the power source which flows the inside of a power-source line as maximum current DC1.5A. In addition, it is constituted from the specification called DV cable by four pins which excluded the power source.

[0022] <<DS-Link coding>> Drawing 15 is drawing for explaining the DS-Link coding method of a data transfer format adopted by 1394 serial bus. By 1394 serial bus, the DS-Link (Data/Strobe Link) coding method is adopted. This DS-Link coding method is suitable for the high-speed serial data communication link, and that configuration needs two signal lines. It has the composition of sending a strobe signal to the twisted pair line from that of delivery and another side in the data which become main one in a twisted pair wire. In a receiving side, a clock is reproduced by taking the exclusive OR of this data that communicates, and a strobe. Since there is no need of sending the information which shows that it is an idle state when there are not circuit magnitude of Controller LSI being made small and data which should be transmitted further, since transfer efficiency being high and a PLL circuit become unnecessary as a merit using this DS-Link coding method compared with 8 / 10B conversion, it is mentioned by the ability making the transceiver circuit of each device into sleeping that reduction of power consumption can be aimed at etc.

[0023] Sequence>> of <<bus reset By 1394 serial bus, Node ID is given to each device (node) connected, and it is recognized as network configuration. When this network configuration has change (for example, when change arises and it is necessary to recognize new network configuration by the change in the number of nodes by the insert and remove of a node, ON/OFF of a power source, etc.), each node which detected change transmits a bus reset signal on a bus, and goes into the mode in which new network configuration is recognized. The detection approach of the change at this time is performed by detecting change of the bias voltage on a 1394 port substrate.

[0024] If a bus reset signal is transmitted from a certain node, BASURI set occurrence will be transmitted to a link layer, and the physical layer of each node will transmit a bus reset signal to other nodes at the same time it receives this bus reset signal. Bus reset is started after all nodes detect a bus reset signal eventually. Bus reset is started also by giving direct instruction to a physical layer by host control from a protocol etc., although started by cable \*\*\*\* which was described previously, and hard detection by the abnormalities in a network etc. Moreover, when bus reset starts, data transfer will be interrupted temporarily and data transfer will be kept waiting during processing of the bus reset concerned. And it is resumed under new network configuration after termination of bus reset. The above is the sequence of bus reset.

[0025] Sequence>> of <<node ID decision After bus reset, each node starts the actuation which

gives ID to each node, in order to build new network configuration. The general sequence to the node ID decision from bus reset at this time is explained using drawing 23 and the flow chart of 24 and 25.

[0026] Drawing 23 is a flow chart which shows the activity of a series of buses until it determines Node ID from BASURI set occurrence and can perform data transfer. First, in step S101, if it monitors continuously that bus reset occurs in a network and bus reset occurs by power-source ON/OFF of a node etc. here, it will move to step S102. At step S102, in order to know the connection situation of a new network from the condition that the network was reset, declaration of a parentage is made between each node by which direct continuation is carried out. In step S103, if it is judged that the parentage was determined among all nodes, it will progress to step S104 and the one root will be determined. In addition, the parentage of step S102 is declared and the root is not determined, either, until it determines a parentage among all nodes.

[0027] If the root is determined at step S104, in step S105, setting out of the node ID which gives ID to each node will be performed. In order of a predetermined node, setting out of Node ID is performed, and setting out is repeatedly performed until ID is given to all nodes (step S106). When it finishes setting ID as all nodes eventually, it means that new network configuration was recognized in all nodes. Therefore, processing progresses to step S107 from step S106, it will be in the condition that data transfer between nodes can be performed, and data transfer will be started.

[0028] And if it will be in the condition of this step S107, it goes into the mode which supervises that bus reset occurs again, and if bus reset occurs, setting out from step S101 to step S106 will be performed repeatedly. Although the above is explanation of the flow chart of drawing 23, the part from bus reset of the flow chart of drawing 23 to root decision and the procedure from after root decision to ID setting-out termination are explained in more detail with reference to drawing 24 and drawing 25. Drawing 24 is a flow chart explaining processing from the bus reset in each node to root decision. Moreover, drawing 25 is a flow chart which shows the procedure from after root decision to ID setting-out termination.

[0029] First, it explains with reference to drawing 24. If bus reset occurs in step S201, network configuration will once be reset and processing will progress to step S202. In addition, at step S201, it is always supervising that bus reset occurs. Next, in step S202, the flag which shows that it is a leaf (node) to each device as a first stage story of the activity which has a new appreciation of the connection situation of the reset network is set.

[0030] Next, in step S203, it investigates how many the port which he has [ each device ] is connected with other nodes. At step S204, in order to begin declaration of a parentage based on the number of ports, undefined (parentage is not determined) number of connections is investigated. immediately after bus reset — number of ports = — although it is the number of undefined ports, the undefined number of connections as which the parentage is determined and which is alike, follows and is detected at step S204 changes.

[0031] First, it is restricted to the leaf immediately after bus reset that a parentage can be declared first. It can know that it is a leaf by the check of the number of ports of step S203. That is, a parentage is [ the number of undefined ports of a leaf ] the thing of 1 in the phase of the undefined. In step S205, to the node connected to itself, a leaf is announced "He is a child and partners are parents", and ends actuation.

[0032] Since the node which the number of ports has recognized to be a branch with two or more at step S203 will call it undefined port number >1 at step S204 immediately after bus reset, it moves from it to step S206, and a flag called a branch is set. And it waits in order to receive "parents" by parentage declaration from a leaf at step S207. Other nodes which are leaves declare a parentage and a carrier beam branch checks the number of undefined ports of step S204 for it suitably at step S207. Here, it becomes possible to declare "Child (for himself to be a child)" of step S205 to the node connected to the port which remains if the number of undefined ports is 1. It waits in order to receive the "parents" from a leaf or other branches at step S207 again to a certain branch two or more, even if it checks the number of undefined ports by processing of step S204 after the 2nd times.

[0033] Eventually, when becoming zero as a result of the check of a leaf (although child

declaration could be made, since it did not operate quickly) of the number of undefined ports of step S204 on any one branch or an exception target Declaration of the parentage of the whole network is completed now, the flag of the root is set in step S208, and, as for the only node from which the number of undefined ports became zero (considering all as parents' port decision), the recognition as the root is made in step S209. Thus, from the bus reset shown in drawing 24 to declaration of the parentage in a network between all nodes is completed.

[0034] Below, the flow chart of drawing 25 is explained. First, since the information on the flag of each node called a leaf, a branch, and the root is set up by the sequence to drawing 24, it carries out based on this and classifies according to step S301, respectively. As an activity which gives ID to each node, it is from a leaf that ID can be set up first. A leaf → branch → setting out of ID is made from the young number (node number = 0) in order of the root.

[0035] In step S302, several Ns (N is the natural number) of the leaf which exists in a network are set up. Then, it is required that each leaf should give ID to the root in step S303. When there are two or more these demands, the root performs an Arbitration in step S304, gives an ID number to one node which won in step S305, and notifies to a negative beam node as a result of failure. The leaf which ID acquisition finished with failure in step S306 advances ID request again, and repeats the same activity.

[0036] The leaf which has acquired ID transmits ID information on the node to all nodes by broadcasting in step S307. After broadcasting of 1 node ID information finishes, in step S308, several Ns per \*\* of the remaining leaf are reduced. Here, in step S309, one or more, in a certain case, several Ns of this remaining leaf repeat the activity of the ID request from step S303, and carries out. And if all leaves broadcast ID information eventually, it will be set to N= 0 in step S309, and will move to step S310 for ID setting out of a branch.

[0037] ID setting out of a branch as well as the time of a leaf is performed. First, several M (M is the natural number) of the branch which exists in a network in step S310 is set up. Then, it is required that each branch should give ID to the root as step S311. On the other hand, in step S312, the root performs an Arbitration and gives it to the degree of the number which it finished giving to a leaf from the young number sequentially from the branch which won. In step S313, the root notifies ID information or a failure result to the branch which advanced the demand. In step S314, the branch which ID acquisition finished with failure advances ID request again, and repeats the same activity.

[0038] It progresses to step S315 from the branch which has acquired ID, and ID information on the node is transmitted to all nodes by broadcasting. After broadcasting of 1 node ID information finishes, one several M of the remaining branch is reduced in step S316. here — step S317 — setting — several [ of this remaining branch ] — in a certain case, M repeats the activity of the ID request from step S311 one or more, and it is carried out until all branches broadcast ID information eventually. If all branches acquire Node ID, it will be set to M= 0 in step S317, and ID acquisition mode of a branch will be completed.

[0039] Since the node which does not acquire ID information eventually is only the root after ending so far, the youngest number is set up with its ID number by the number which has not been given in step S318, and ID information on the root is broadcast as step S319. As shown in drawing 25, after determining a parentage above, a procedure until ID of all nodes is set up is completed.

[0040] Next, the network construction actuation at the time of the bus reset in the actual network shown in drawing 16 is explained as an example. Drawing 16 is drawing for explaining the network construction actuation at the time of bus reset. In drawing 16, direct continuation of Node A and the node C is carried out to the low order of Node B (root), direct continuation of the node D is further carried out to the low order of Node C, and it has a layered structure by which direct continuation of Node E and the node F was further carried out to the low order of Node D. The procedure of determining such a layered structure and a root node, and Node ID is explained below.

[0041] After bus reset is carried out, in order to recognize the connection situation of each node first, declaration of a parentage is made between the ports where direct continuation of each node is carried out. With this parent and child, a parents side can say that it becomes a high order by the layered structure, and a child side serves as low order. At drawing 16, Node A declared the

parentage to the beginning after bus reset. A parentage can be declared from the node (it is called a leaf) which has connection only in one port of a node fundamentally. Since it can know first that he has only connection of one port as for this, it recognizes that it is a network edge by this, and the parentage is determined from the node which operated early in it. In this way, the port of the side (between A-B the node A) which declared the parentage is set up with a child, and the port of the other party (node B) is set up with parents. In this way, between node A-B, it is decided between child-parents and node F-D between child-parents and node E-D that they will be child-parents.

[0042] the first [ further ] floor layer — it goes up and the parentage is shortly declared to the high order further for declaration of the parentage from other nodes one by one from the carrier beam thing among nodes (it is called a branch) with two or more connection ports. In drawing 16 , first, Node D is declaring the parentage to Node C, after determining a parentage between D-E and between D-F, and as a result, it is decided between node D-C that they will be child-parents.

[0043] The carrier beam node C is declaring the parentage to the node B by which declaration of the parentage from Node D is connected to another port. It is decided between node C-B by this that they will be child-parents. Thus, a layered structure like drawing 16 will be constituted and the node B which became parents in all the ports connected eventually will be determined as a root node. As for the root, only one exists during one network configuration.

[0044] In addition, although Node B was determined as the root node in this drawing 16 , if, as for this, the carrier beam node B is making Node A to parentage declaration parentage declaration to early timing to other nodes, it has moved from the root node to other nodes. That is, depending on the timing transmitted, every node may turn into a root node, and a root node is not necessarily regularity in the same network configuration, either.

[0045] If a root node is determined, next, it will go into the mode in which each node ID is determined. Here, all nodes notify their node ID to all other nodes (broadcasting function). [ who determined ] Self-ID information includes the information on its node number, the information on the location connected, the number of connections that it has, number of connections with connection, and the parentage of each port etc.

[0046] from the node (leaf) which has connection only in one port first as a procedure of assignment of a node ID number — it can start — the order from this inside — node number = — it is assigned with 0, 1, and 2 —. The node which gained Node ID transmits the information containing a node number to each node by broadcasting. It is recognized by this that the ID number is "finishing [ assignment ]."

[0047] If all leaves finish acquiring the self-node ID, the node ID number which next moved to the branch and followed the leaf will be assigned to each node. Node ID information is broadcast one by one like a leaf from the branch to which the node ID number was assigned, and, finally a root node broadcasts self-ID information. That is, the root always owns the greatest node ID number.

[0048] Assignment of the node ID of the whole layered structure finishes as mentioned above, network configuration is reconstructed, and the initialization activity of a bus is completed.

<<Arbitration>> By 1394 serial bus, the Arbitration (mediation) of a bus royalty is surely performed in advance of data transfer. Since a 1394 serial bus is a logical bus mold network as each device connected according to the individual tells this signal in a network to all devices by relaying the transmitted signal, respectively, the Arbitration is required of the semantics which prevents the collision of a packet. Only one node can transmit to a certain time amount by this.

[0049] Drawing 17 is drawing explaining the Arbitration in a 1394 paper real bus. Especially (a) of drawing 17 </A> shows the flow of a bus activity demand, and (b) of drawing 17 shows the flow of bus licence. If an Arbitration starts, one or two or more nodes will emit a demand of a bus royalty toward a parent node, respectively. Node C and Node F of drawing 17 (a) are a node which has emitted the demand of a bus royalty. A carrier beam parent node (drawing 17 the node A) emits a demand of a bus royalty for this toward a parent node further (it acts as intermediary). This demand is sent to the root which arbitrates eventually.

[0050] It decides whether a carrier beam root node (node B) makes a bus use a bus activity demand for which node. This mediation can perform only a root node and the licence of a bus is given to the node which won by mediation. By (b) of drawing 17 , licence is given to Node C and it

is shown that the activity demand of Node F was refused. It tells that delivery and a demand were refused by the Arbitration in DP (data prefix) packet to the negative beam node. The bus activity demand of the node by which the demand was refused is kept waiting to a next Arbitration.

[0051] The node which won the Arbitration as mentioned above and obtained the licence of a bus can start a data transfer henceforth. Here, a series of flow of an Arbitration is explained with reference to flow chart drawing 26 . Drawing 26 R> 6 is a flow chart showing the procedure of an Arbitration. In order for a node to be able to start data transfer, it is required for a bus to be an idle state. In order to complete the data transfer currently performed previously and to recognize that a current bus is idle status, it is judged that each node can start a transfer of it by going through the predetermined idle-time gap length (example . subtraction gap) set up according to the individual by each transfer mode.

[0052] In step S401, it judges whether the predetermined gap length according to data transmitted, respectively, such as Async data and Iso data, was obtained. Since a demand of a bus royalty required in order to start a transfer cannot be performed unless predetermined gap length is obtained, it waits until predetermined gap length is obtained. If gap length predetermined at step S401 is obtained, it judges whether there are any data which should be transmitted in step S402, and if it is, it will progress to step S403.

[0053] At step S403, in order to carry out data transfer, a demand of a bus royalty is emitted to the root so that a bus may be secured. Transfer of the signal showing the demand of a bus royalty at this time is eventually sent to the root, relaying each device in a network, as shown in (a) of drawing 17 . On the other hand, when there are no data transmitted at step S402, it stands by as it is. Next, in step S404, a root node receives the bus activity demand published at step S403. And in step S405, the root investigates the number of nodes which advanced the activity demand. When the number of nodes which advanced the activity demand by step S405 is 1 (the node which advanced the royalty demand is one), the next bus licence will be given to the node. On the other hand, in step S405, if it is node number >1 (the node which advanced the activity demand is plurality), the root will perform mediation which determines the node which gives licence in step S406 as one. It has the composition that access is equally granted so that this mediation may be fair and only the nodes same each time may not obtain authorization (fair Arbitration).

[0054] Next, in step S407, selection divided into one node which the root arbitrated out of two or more nodes which advanced the activity demand by step S406, and obtained licence, and the node of others which were beaten is performed. one node which was arbitrated and obtained licence here, or step S405 — setting — the number of activity demand nodes — the root sends an enabling signal to the node which obtained licence without mediation by =1 to the node as step S408. The node which acquired the enabling signal carries out transfer initiation of the data (packet) which should be transmitted immediately after receiving. Moreover, mediation of step S406 is lost, and in step S409, DP (data prefix) packet which shows Arbitration failure is sent from the root, and to it, the node which received this stands by until return and predetermined gap length are obtained to step S401 by the node to which a bus activity was not permitted, in order to advance the bus activity demand for transmitting again.

[0055] The above is the flow of the Arbitration by the 1394 serial bus.

<< — asynchronous (Asynchronous, asynchronous) transfer>> — an asynchronous transfer is asynchronous transmission. Drawing 18 is drawing showing the time transition state in an asynchronous transfer. The subtraction gap of the beginning of drawing 18 shows the idle state of a bus. When this idle time becomes constant value, it judges that the node which wishes to transmit can use a bus, a bus activity demand is published, and the Arbitration for bus acquisition is performed.

[0056] If the licence of a bus is obtained by the Arbitration, a data transfer will be performed in a packet format next. A transfer completes the node which received the data concerned after data transfer by returning ack of a receiving result to the transmitted data (return code for the confirmation of receipt) after a short gap called ack gap, and answering, or sending a response packet. ack consists of 4 bits information and a 4-bit checksum, and a transmitting agency node is immediately returned including the information whether they are a success, a busy condition, and pending status.

[0057] Next, the packet format of an asynchronous transfer is explained. Drawing 19 is drawing showing the example of the packet format of an asynchronous transfer. There are data division and a header unit other than the data CRC for error corrections in a packet. The object node ID, the source node ID, transfer data die length, various codes, etc. as shown in drawing 19 are written in a header unit, and a transfer is performed. Moreover, an asynchronous transfer is the communication link of 1 to 1 to a partner node from a self-node. Although the packet transmitted from the source node spreads round each node in a network, since things other than the address addressed to themselves are disregarded, only one node of the destination will read. The above is explanation of an asynchronous transfer.

[0058] <<isochronous (Isochronous, synchronization) transfer>> An isochronous transfer is synchronous transmission. Especially this isochronous transfer that can be said to be the greatest description of a 1394 serial bus is the transfer mode suitable for the data transfer which needs the real time transfer of image data, multimedia data called voice data. Moreover, as for this isochronous transfer, data are uniformly transmitted to all other nodes from one node of the source by the broadcasting function to the asynchronous transfer (asynchronous) having been a transfer of 1 to 1.

[0059] Drawing 20 is drawing in an isochronous transfer showing a time transition state. An isochronous transfer is performed for every fixed-on bus time amount. This time interval is called an isochronous cycle. The isochronous cycle time is 125 microseconds. The cycle-start packet is bearing the role which shows the start time of each of this cycle and performs timing of each node. The node called a cycle master transmits a cycle-start packet, and after the data transfer termination in the cycle in front of one, after passing through a predetermined idle period (subaction gap), it transmits the cycle-start packet which tells initiation of this cycle. The time interval to which this cycle-start packet is transmitted is set to 125 microseconds.

[0060] Moreover, as it was indicated in drawing 20 as Channel A, Channel B, and Channel C, when two or more sorts of packets can give Channel ID into 1 cycle, respectively, it can distinguish and transmit. By this, the real time transfer between two or more nodes is simultaneously possible, and he incorporates only the data of the channel ID needed by the node which receives. This channel ID does not express the address of a transmission place, and has given the logical number to data. Therefore, transmission of a certain packet will be transmitted by broadcasting which spreads round all other nodes from the transmitting agency node of one.

[0061] In advance of packet transmission of an isochronous transfer, an Arbitration is performed like an asynchronous transfer. However, since it is not the communication link of 1 to 1 like an asynchronous transfer, ack (reply code for the confirmation of receipt) does not exist in an isochronous transfer. Moreover, it was shown in drawing 20 . iso gap (isochronous gap) expresses the idle period required in order to recognize it as a bus being idle status before performing an isochronous transfer. If this predetermined idle period passes, it can judge that the bus is vacant as for a node to perform an isochronous transfer, and the Arbitration before a transfer can be performed.

[0062] Below, the packet format of an isochronous transfer is explained. Drawing 21 is drawing showing the example of the packet format of an isochronous transfer. There is a header unit other than the data CRC for data division and error corrections in various kinds of packets divided into each channel, respectively. A transfer data length as shown in drawing 21 , channel NO., other various codes, the header CRC for error corrections, etc. are written in the header unit, and a transfer is performed. The above is explanation of an isochronous transfer.

[0063] <<bus cycle>> An isochronous transfer and an asynchronous transfer can be intermingled in the transfer on a actual 1394 serial bus. Drawing 22 is drawing showing the signs of time transition of the transfer condition on a bus that the isochronous transfer and the asynchronous transfer were intermingled. Priority is given to an isochronous transfer over an asynchronous transfer, and it is performed. The reason is gap length (isochronous gap) shorter than the gap length (subaction gap) of an idle period required in order to start an asynchronous transfer after a cycle-start packet, and is because an isochronous transfer can be started. Therefore, an isochronous transfer will be given priority to and performed from an asynchronous transfer.

[0064] In the general bus cycle shown in drawing 22 , a cycle-start packet is transmitted to each

node from a cycle master at the time of the start of cycle #m. By this, after performing time-of-day adjustment by each node and waiting for a predetermined idle period (isochronous gap), the node which should perform an isochronous transfer performs an Arbitration and starts a packet transfer. In drawing 22, the isochronous transfer of Channel e, Channel s, and the channel k is carried out at order.

[0065] An asynchronous transfer can be performed, if all isochronous transfers in cycle #m are completed after performing actuation from this Arbitration to a packet transfer repeatedly by the channel to which it is given. When the idle time reaches the subaction gap which can be transmitted asynchronously, it is judged that it can move from a node to perform an asynchronous transfer to activation of an Arbitration. However, the period which can perform an asynchronous transfer is restricted when the subaction gap for starting an asynchronous transfer from after isochronous transfer termination before the time amount (cycle synch) which should transmit the following cycle-start packet is obtained.

[0066] In cycle #m of drawing 22, 2 packet (packet 1, packet 2) transfer of the asynchronous transfer (ack is included) is carried out after that with the isochronous transfer for three channels. Since after this asynchronous packet 2 results in the time amount (cycle synch) which should start a cycle m+1, the transfer by cycle #m is finished even here.

[0067] However, supposing it results in the time amount (cycle synch) which should transmit the following cycle-start packet during asynchronous or synchronous transmission actuation, it is not interrupted by force, but after waiting for the idle period after the transfer is completed, the cycle-start packet of degree cycle will be transmitted. That is, when one cycle continues 125 microseconds or more, degree cycle presupposes that much that it was shortened from 125 microseconds of criteria. Thus, on the basis of 125 microseconds, an isochronous cycle is exceeded and can be shortened. However, if an isochronous transfer is the \*\* cycle need in order to maintain a real-time transfer, it may surely be performed, and an asynchronous transfer may be turned to the cycle after a degree by having shortened the cycle time. It is managed by the cycle master also including such delay information.

[0068] < — operation — a gestalt — one — > — this invention — operation — a gestalt — one —  
— \*\*\*\* — an image processing system — an output unit — connecting — having — the — an  
image processing system — processing — having had — image data — being based — an image —  
— an output unit — outputting — an image processing system — setting — an image processing  
system — \*\*\*\*\* — a digital camera — an output unit — \*\*\*\*\* — a printer — having  
constituted — drawing 4 — R — > — four — being shown — as — an image processing system —  
— an example — mentioning — explaining .

[0069] First, the functional configuration and its actuation of a digital camera are explained using drawing 2. Drawing 2 is the block diagram showing the functional configuration of the digital camera of the operation gestalt 1 of this invention. In addition, the case where the image corresponding to the image data shown in drawing 1 is recorded is mentioned as an example, and is explained here.

[0070] First, image formation of the image obtained from a lens system 21 is carried out on the 22nd page of a CCD component. The analog signal acquired from the CCD component 22 is changed into a digital signal by the A/D-conversion section 23. It is transmitted to the image-processing section 24, and the changed digital signal is changed into the image data to which image processings, such as color transform processing, edge enhancement processing, and gamma correction processing, were performed. Next, image data is transmitted to the image transformation section 25. In the image transformation section 25, for every several pixels recordable [ with one scan of the recording head of a printer ], it is divided, and JPEG compression is carried out for every divided image data, and image data is recorded on the data-logging section 26.

[0071] In addition, management of record in the data-logging section 26 of image data is performed based on the address of the data-logging section 26. For example, when image data A for the record medium of one sheet used for record of a printer is divided into three image data A1 and A2 and A3 and JPEG compression is carried out, each start address of image data A1 and A2 and the data-logging section 26 on which A3 is recorded is managed by the address Management

Department in the data-logging section 26 (un-illustrating).

[0072] The above processings are performed also to image data B and image data C. In this case, it is divided into image data B1, B-2, and B3, JPEG compression is carried out, image data B is recorded on the data-logging section 26, it is divided into image data C1, C2, and C3, JPEG compression is carried out, and image data C is recorded on the data-logging section 26. Next, the functional configuration and actuation of the printer connected to the above-mentioned digital camera are explained using drawing 3.

[0073] In addition, the printer of the operation gestalt 1 presupposes that it is the ink jet printer which carried the recording head by the ink jet method, and a recording head presupposes that 64 nozzles are arranged, respectively in the scanning direction (pixel direction) and a direction (the direction of a line) vertical to the scanning direction of a recording head, i.e., the conveyance direction of a record medium. Moreover, each nozzle corresponds to 1 pixel of image data, and a record medium presupposes that the cut sheet of A4 size is used.

[0074] Drawing 3 is the block diagram showing the functional configuration of the printer of the operation gestalt 1 of this invention. A user first chooses the image data recorded by how many the image data recorded on the data-logging section 26 in a digital camera is recorded or which image data is recorded, and the printer by the interface section 31 on a printer. In addition, although not explained in full detail, as long as the selection of image data recorded by the printer has a display in a digital camera, it may display and choose the image data currently recorded on the data-logging section 26 on the display, and may choose it using the index print of the image data recorded on the data-logging section 26.

[0075] Here, the case where one image data A currently recorded on the data-logging section 26 is recorded on the record medium of A4 size is mentioned as an example, and is explained. If the image data (image data A) recorded by the printer is chosen, a printer will transmit the request signal for obtaining image data from the interface section 31 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits one of the image data which divided image data A and carried out JPEG compression to a printer so that it may reply to the request signal.

[0076] In addition, as mentioned above, the division unit which divides image data A is determined by several pixels recordable by one scan of the recording head of a printer. For example, since the number of the nozzles of the pixel direction of a recording head (pixel number) is 64 when image data A is 832 pixel (line) x 640 pixel (pixel), image data A is divided per 832 pixel (line) x 64 pixels (pixel). That is, JPEG compression of each is carried out and image data A is recorded on the data-logging section 26, after being divided into A9 and 10 of A10, image data A1, A2, A3, --.

[0077] Moreover, before the number of pixels recordable by one scan of a recording head transmits to a printer the image data which a user sets up from the interface section 27 of a digital camera beforehand, or is recorded on the data-logging section 26 of a digital camera, it may be made a configuration which a printer notifies to a digital camera. moreover -- or you may set up as a default beforehand like the operation gestalt 3 mentioned later.

[0078] Next, the image data (for example, image data A1) which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 32. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 32 is carried out. As for the image data A1 by which JPEG thawing was carried out, color transform processing and binary-ized processing are made by the print image-processing section 33. The image data A1 made binary is transmitted to the record position control processing section 34, and the location which should record on a record medium is managed.

[0079] In addition, position control in the record position control processing section 34 is performed by controlling the write-in location of the buffer memory 36 corresponding to the image data made binary. Next, it is transmitted to the head actuation signal transformation section 35, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 36. And based on the position control by the record position control processing section 34, a record signal is transmitted to printer engine 37 one by one, and the image based on

the record signal is recorded on a record medium.

[0080] The above is a record procedure by one scan of the recording head of the printer of the operation gestalt 1. If record by one scan of a recording head is completed, in order to obtain image data required for record of 1 scan of the following recording head from a digital camera by the interface section 31 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A2) required for one scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to the image data A2 which received from the digital camera and by which JPEG compression was carried out is recorded on a record medium by the same record procedure mentioned above.

[0081] If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. Next, the record procedure in the case of recording two or more images on the scanning direction of a recording head is explained. In addition, in order to simplify explanation, the image data which a printer chooses and to record shall be set up so that the image A corresponding to image data A and the image B corresponding to image data B may be recorded on the scanning direction of a recording head, as image data A mentioned above, image data A, and image data B of the same size are chosen and it is shown in drawing 6.

[0082] First, image data A corresponding to the image A inputted from the digital camera and image data B corresponding to Image B are the same record procedures mentioned above, and JPEG compression is divided and carried out for every several pixels recordable by one scan of a recording head, and they are recorded on the data-logging section 26. Then, the request signal of image data more nearly required for record than a printer is transmitted to a digital camera. The digital camera which received the request signal from the printer transmits to a printer the image data A1 by which JPEG compression was carried out, then the image data B1 by which JPEG compression was carried out as image data required for one scan of the recording head of the beginning of a printer.

[0083] And a printer receives the image data A1 by which JPEG compression was carried out from a digital camera, and once stores it in the position of buffer memory 36 through an above-mentioned record procedure. Then, the image data B1 by which JPEG compression was carried out is received from a carrier digital camera, and it once stores in a different location from the location where the image data A1 of buffer memory 36 is stored by the same record procedure. If image data A1 and image data B1 are stored in buffer memory 36, based on the position control of the record position control processing section 34, the image which is transmitted to printer engine 37 one by one, and corresponds will be recorded on a record medium.

[0084] If it carries out one by one to image data A10 and image data B10 and image data A2, image data B-2, image data A3, image data B3, —, the image corresponding to image data A10 and image data B10 are recorded on a record medium, record of the image A corresponding to image data A and the image B corresponding to image data B will complete the above record procedures.

[0085] In addition, although the operation gestalt 1 explained the configuration which outputs the image which connects to a printer the image data currently recorded on the data-logging section 26 of a digital camera, and corresponds, it cannot be overemphasized that the image which connects with a personal computer and corresponds to drawing 5 so that it may be shown can be outputted to the monitor of a personal computer. Moreover, although the case where two images A and Image B were put in order and recorded on the scanning direction of a recording head as an example which records two or more images was explained, it is also possible to put in order and record two or more images on the scanning direction of a recording head. Furthermore, it is also possible to put in order and record two or more images in the scanning direction of a recording head as shown in drawing 7, and the conveyance direction of a record medium.

[0086] Furthermore, as a compression method of the image data corresponding to the image inputted into the digital camera, although the JPEG compression method is used, it is not limited to this. According to the operation gestalt 1, as explained above, the image data inputted from the

digital camera is divided for every number of pixels recordable by one scan of the recording head of a printer, and since the divided image data is received and recorded for every scan of a recording head, \*\* which performs efficiently the send action of the image data from a digital camera to a printer and record actuation of a printer is made. Consequently, the total throughput of an image processing system can be improved.

[0087] Moreover, since it records by carrying out sequential reception of the image data required for one scan of the recording head of a printer, the buffer memory 36 with the memory capacity for memorizing the image data of the whole image recorded on a record medium is not needed. Consequently, the storage capacity of buffer memory 36 can be reduced.

With the <operation gestalt 2> operation gestalt 2, a digital camera and a printer are connected and the image processing system which expands or reduces the size of the image corresponding to the image data inputted with the digital camera, and is recorded by the printer is explained as an operation gestalt 2.

[0088] In addition, since it is the same as that of drawing 1 of the operation gestalt 1 about the functional configuration and actuation of the digital camera of the operation gestalt 2, the detail is omitted here. Next, the functional configuration and actuation of the printer of the operation gestalt 2 are explained using drawing 8. Drawing 8 is the block diagram showing the functional configuration of the printer of the operation gestalt 2 of this invention.

[0089] In addition, the recording head of the printer of the operation gestalt 2 presupposes that the same thing as the recording head of the printer of the operation gestalt 1 is used. First, by the interface section 31 on a printer, a user sets up the scale factor of the size of the image to record, amplification, or a cutback while choosing the image data recorded by how many the image data recorded on the data-logging section 26 in a digital camera is recorded or which image data is recorded, and the printer. In addition, although not explained in full detail, as long as the selection of image data recorded by the printer and setting out of size have a display in a digital camera, they may display and choose the image data recorded on the data-logging section 26 on the display, and may choose it using the index print of the image data recorded on the data-logging section 26.

[0090] Here, the case where expand image data A of the operation gestalt 1 mentioned above twice, and one sheet is recorded on the record medium of A4 size is mentioned as an example, and is explained. If selection and its size to record are set up for the image data (image data A) recorded by the printer, a printer will transmit the request signal for obtaining image data from the interface section 81 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits to a printer the image data A1 which divided image data A and carried out JPEG compression so that it may reply to the request signal.

[0091] The image data A1 which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 82 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 1 (83). The image data stored in buffer memory 1 (83) is the print image-processing section 84, and conversion of image size is performed. since it is here set up so that image data may be expanded twice -- the inside of buffer memory 1 (83) to the image data A1 (832 pixels x 64 pixels), and 832pixelx -- reading appearance of the image data for 32 pixels is carried out, and it expands to 1664 pixel x64 pixel image data by well-known scale-factor transform processing.

[0092] And color transform processing and binary-ized processing are made to the expanded image data. The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed. In addition, position control in the record position control processing section 85 is performed by controlling the write-in location of the buffer memory 2 corresponding to the image data made binary (87). And it is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87). And based on the position control by the record position control processing section 85, a record

signal is transmitted to printer engine 88 one by one, and the image based on the record signal is recorded.

[0093] next, remaining 832pixels of the image data A1 stored in buffer memory 1 (83) — the image data for 32 pixels is recorded on the location which should be recorded on a record medium with the same procedure. If all the image data stored in buffer memory 1 (83) is recorded, a printer will transmit the request signal of the following image data A2 to a digital camera. And if the following image data A2 is received from a digital camera, the image corresponding to image data A2 will be recorded on the location which should record on a record medium with the same procedure performed to image data A1. If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. Next, the case where reduce image data A to 1/2, and one sheet is recorded on the record medium of A4 size is explained.

[0094] If selection and its size to record are set up for the image data (image data A) recorded by the printer, a printer will transmit the request signal for obtaining image data from the interface section 81 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits to a printer the image data A1 which divided image data A and carried out JPEG compression so that it may reply to the request signal. The image data A1 which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 82 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 83. The image data stored in buffer memory 1 (83) is the print image-processing section 84, and conversion of image size is performed. Here, since it is set up so that image data may be reduced to 1/2, image data A1 (832 pixels x 64 pixels) is read from buffer memory 1 (83), and it reduces to 416 pixel x32 pixel image data by well-known scale-factor transform processing. And color transform processing and binary-ized processing are made to the reduced image data. The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed. It is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87).

[0095] Next, with the same procedure, image data A2 is received from a digital camera, and the record signal corresponding to image data A2 is stored behind the location where the record signal corresponding to the image data A1 of buffer memory 2 (87) is stored. image data A1 and A2 — if it is alike, respectively and the record signal of two corresponding is stored in buffer memory 2 (87), each record signal will be transmitted to printer engine 88 one by one based on the position control by the record position control processing section 85, and the image based on the record signal will be recorded on a record medium.

[0096] It is a record procedure by one scan of a recording head in case the above reduces and records image data on 1/2. After record by one scan of a recording head is completed, in order to obtain image data required for record of 1 scan of the following recording head from a digital camera by the interface section 81 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A3, A4) required for the scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to image data A3 and A4 which received from the digital camera and by which JPEG compression was carried out is recorded on the location which should record on a record medium by the same record procedure mentioned above. If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. In addition, although the case where it expands and records twice as size of image data to record, and the case where it reduced and recorded on 1/2 were mentioned as the example and the operation gestalt 2 explained them, it expands by 3 times and 4 times, and when reducing and

recording record, 1/3 time, and 1/4 time, it can respond in the same procedure. Moreover, although the case where one image was recorded on a record medium was explained here, as the operation gestalt 1 explained, it is also possible to record two or more images on a record medium. As explained above, also when according to the operation gestalt 2 changing the size of the image data inputted with the digital camera and recording the image corresponding to the changed image data by the printer, the same effectiveness as the operation gestalt 1 can be acquired.

[0097] With the <operation gestalt 3> operation gestalt 1 and the operation gestalt 2, although it was the configuration of inputting several pixels which are the units which divide the image data inputted from the digital camera from a user or a printer, the default beforehand determined in this may be used. The digital camera and printer by which several pixels which are the units to divide are hereafter determined by the default are connected, and the image processing system which records the image corresponding to the image data inputted with the digital camera by the printer is explained as an operation gestalt 3.

[0098] In addition, since it is the same as that of the operation gestalt 2 about the functional configuration and actuation of the digital camera of the operation gestalt 3, and a printer, the detail is omitted here. Moreover, generally the number of nozzles of the recording head of a printer turns into a multiple of eight on the problem of data control. namely, . Several pixels which become recordable by one scan of a recording head serve as a multiple of 8. Therefore, several pixels which are the units which divide the image data beforehand determined within the digital camera are set as the multiple of 8. Moreover, it is desirable to set several pixels as the multiple of 8 also from the compression unit of the JPEG compression to image data being 8 pixel x8 pixel.

[0099] Here, within a digital camera, several pixels which are the units which divide the image data determined beforehand are 32, and the case where one image data A of the operation gestalt 1 mentioned above is recorded on the record medium of A4 size is mentioned as an example, and is explained. first — since the size of image data A currently recorded on the data-logging section 26 is 832 pixel x640 pixel in a digital camera — image data A — 832pixelx — the image data A1 and A2 in every 32 pixels, and — it is divided into 20 of A20, JPEG compression is carried out, and it is recorded on the data-logging section 26. And if the request signal for obtaining image data from the interface section 31 of a printer is transmitted to a digital camera, a digital camera will transmit several pixels (here 32) which are the division units of image data to a printer. A printer measures the several pixels and several pixels recordable by one scan of a recording head, and determines the number of the image data which can receive from a digital camera at a time and by which JPEG compression was divided and carried out based on the comparison result. (With the operation gestalt 3, since several pixels recordable by one scan of a recording head are 64, the image data whose number is two and which was divided and compressed is needed.)

Then, a printer receives the image data A1 by which JPEG compression was carried out from a digital camera, and the image data A1 which received and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 32 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 1 (83). Then, the image data A2 by which JPEG compression was carried out is received from a digital camera, and it stores in buffer memory 1 (83) in the same procedure. Color transform processing and binary-ized processing are made to the image data stored in the buffer memory 1 (83). The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed.

[0100] Next, it is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87). And based on the position control by the record position control processing section 85, a record signal is transmitted to printer engine 88 one by one, and the image based on the record signal is recorded on a record medium.

[0101] It is a record procedure by one scan of a recording head in case several pixels whose above is the units which divide the image data in a digital camera are determined beforehand. After record by one scan of a recording head is completed, in order to obtain image data required for

record of 1 scan of the following recording head from a digital camera by the interface section 81 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A3, A4) required for the scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to image data A3 and A4 which received from the digital camera and by which JPEG compression was carried out is recorded on the location which should record on a record medium by the same record procedure mentioned above.

[0102] If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A20 is recorded on a record medium, record of the image corresponding to image data A will be completed. In addition, several pixels which are the units which divide the image data in a digital camera with the operation gestalt 3 are although it was determined beforehand 32. If it is the multiple of 8, it will not be restricted to this.

[0103] As explained above, even when several pixels which are the units which divide the image data in a digital camera are determined beforehand according to the operation gestalt 3, image data required for one scan of a recording head can be received by measuring the several pixels and several pixels recordable by one scan of the recording head of a printer. Therefore, also in such a case, the same effectiveness as the operation gestalt 1 can be acquired.

[0104] In addition, the decision approach of several pixels which are the division units which divide image data within the digital camera of the image processing system of this invention is divided roughly into two, the approach of acquiring from several pixels recordable by the input from a user, or one scan of the recording head of a printer, and the approach of determining beforehand within the digital camera. If its attention is paid to this viewpoint, the operation gestalten 1 and 2 correspond to the approach of gaining several pixels which are division units from the input or printer from a user, and the approach the operation gestalt 3 determines several pixels beforehand within the digital camera.

[0105] Then, the processing performed with the image processing system in the operation gestalten 1 and 2 as an outline of the processing performed with the image processing system of this invention and the processing performed with the image processing system in the operation gestalt 3 are explained using the flow chart of drawing 9 and drawing 1010. First, the outline of the processing performed with the image processing system in the operation gestalten 1 and 2 is explained using drawing 9.

[0106] Drawing 9 is a flow chart which shows the outline of processing of the image processing system of the operation gestalten 1 and 2 of this invention. First, the number of pixels recordable by one scan of a recording head is gained from the input or printer from a user at step S101 to a digital camera side. Next, according to the gained number of pixels, image data is divided at step S202. Next, JPEG compression of the divided image data is carried out, and it records on the data-logging section 26.

[0107] boil selection of the image data made to output to a printer side at step S104, and setting out of image size interface section 31 (or interface section 81) — it \*\*\*\*\*. The image data by which JPEG compression was carried out from the digital camera at step S105 according to the input from the interface section 31 (or interface section 81) is inputted. At step S106, JPEG thawing of the inputted image data by which JPEG compression was carried out is carried out. After performing a required image processing at step S107 to the image data by which JPEG thawing was carried out, it records with printer engine 37 (or printer engine 88).

[0108] Next, the outline of the processing performed with the image processing system in the operation gestalt 3 is explained using drawing 10. Drawing 10 is a flow chart which shows the outline of processing of the image processing system of the operation gestalt 3 of this invention. First, image data is divided according to the predetermined number of pixels which is the division unit of the image data beforehand determined as the digital camera side at step S201. Next, at step S202, JPEG compression of the divided image data is carried out, and it records on the data-logging section 26.

[0109] The information which shows from a printer the predetermined number of pixels which is the division unit of image data at step S203 is inputted into a printer side. Step S204 compares the inputted predetermined number of pixels, and the number of pixels recordable by one scan of

the recording head of a printer. The image data by which JPEG compression was carried out from the digital camera at step S205 based on the comparison result is inputted. At step S206, JPEG thawing of the inputted image data by which JPEG compression was carried out is carried out. After performing a required image processing at step S207 to the image data by which JPEG thawing was carried out, it records with printer engine 88.

[0110] Since the image data by which JPEG compression of the image by which partial division was carried out within the digital camera was carried out is transmitted to a printer by needed image data according to the operation gestalt 1 – the operation gestalt 3 as explained above, the time amount of a transfer can be shortened. Moreover, since image data is received and recorded for every number of pixels recordable by one scan of the recording head of a printer, it becomes possible to reduce the storage capacity of buffer memory greatly compared with the former. What is necessary is to face acquiring the output unit information which shows the output unit of the image data of an output unit, and just to obtain in the operation gestalt of this invention, by communicating the asynchronous packet shown in drawing 22 . Moreover, it may face compressing the inputted image data based on this output unit information, and you may receive by the isochronous packet which shows this image data to drawing 22 , and may receive by the asynchronous packet. Receiving by the isochronous packet is desirable in respect of a receiving rate. Moreover, receiving by the asynchronous packet is desirable in respect of the soundness of received data. Moreover, although the IEEE1394 serial bus was mentioned as the example and this operation gestalt explained it, this invention may not be limited to this, other interfaces, for example, the interface called USB, are sufficient as it, and the interface of the other method is sufficient as it.

[0111] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device. Moreover, it cannot be overemphasized by the object of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained.

[0112] In this case, the function of the gestalt of operation which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention. As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0113] Moreover, it cannot be overemphasized that it is contained also when the function of the gestalt of operation which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized. Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional add-in board inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

[0114]

[Effect of the Invention] The image processing system which can improve a total throughput and its control approach, an image processing system, an output unit, and a storage can be offered without raising cost according to this invention, as explained above.

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**TECHNICAL FIELD**

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[Field of the Invention] This invention relates to the image processing system which processes to the inputted image data and is outputted to an output unit and its control approach, an image processing system, an output unit, and a storage.

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**PRIOR ART**

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[Description of the Prior Art] Conventionally, the image data photoed with the digital camera was transmitted with personal \*\*, and the output of image data was performed by the printer connected with the personal computer. However, in order to enable the activity of a digital jar also at the user who is not a personal computer user, direct continuation of a digital camera and a printer is made possible, and the image processing system which can record the image based on image data is developed.

[0003] The storage capacity of the storage for generally memorizing the image data based on the photoed image to a digital camera has a limit. Therefore, in order to enable it to memorize as many image data as possible to the storage, JPEG compression of the image data is carried out, and it memorizes to a storage. In order to perform record (direct print) by the printer by which direct continuation was carried out to the digital camera in such image data by which JPEG compression was carried out, the storage which has the storage capacity for the image amount of data obtained by carrying out JPEG thawing of the image data by which JPEG compression was carried out in a digital camera or a printer is needed. Now, the printer of the image processing system which has realized this direct print does not record a part for the image data plurality of A6 size in the record actuation which records on the record medium of one sheet for A6 size. Therefore, it is realizable if there is a storage (buffer memory) with the memory capacity for image data of A6 size. However, like drawing 1 , when recording three images, A, B, and C, on the record medium of A4 size in the scanning direction of the recording head of a printer, [ for example, ] Since the number of pixels recordable by one scan of a recording head is limited, in the scan of the recording head which is the 1st time What is necessary is just to memorize the image data corresponding to the record section of each record medium to buffer memory one by one, as the image data corresponding to the parts of A1, B1, and C1 in drawing 1 was said to buffer memory as the parts of A2 in drawing 1 , B-2, and C2 by storage and the scan of the 2nd recording head.

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**EFFECT OF THE INVENTION**

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**[Effect of the Invention] The image processing system which can improve a total throughput and its control approach, an image processing system, an output unit, and a storage can be offered without raising cost according to this invention, as explained above.**

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional image processing system, although it becomes possible by having the buffer memory for three image data which carried out JPEG thawing of the image data of A, B, and C of A4 size by which JPEG compression was carried out in a digital camera or a printer in order to realize the above records, problems, such as cost, to implementation is difficult for this.

[0005] Moreover, it has the buffer memory for one image data which carried out JPEG thawing of the image data of A4 size by which JPEG compression was carried out in a digital camera or a printer. The image data of A JPEG thawing, the writing to the buffer memory of the image data of inner A1 part of the image data of A, The image data of B JPEG thawing, the writing to the buffer memory of the image data of inner B1 part of the image data of B, JPEG thawing of the image data of C, the writing to the buffer memory of the image data of inner C1 part of the image data of C, The scan of the 1st recording head, and the image data of A JPEG thawing, the writing to the buffer memory of the image data of inner A2 part of the image data of A, The image data of B JPEG thawing, the writing to the buffer memory of the image data of the inner B-2 part of the image data of B, Although buffer memory can also be saved by performing record, such as JPEG thawing of the image data of C, writing to the buffer memory of the image data of inner C2 part of the image data of C, and a scan of the 2nd recording head Since the count the image data by which JPEG compression was carried out carries out [ a count ] JPEG thawing increases, the problem that a recording rate falls occurs.

[0006] It aims at offering the image processing system which can improve a total throughput and its control approach, an image processing system, an output unit, and a medium, without making this invention in view of the above-mentioned trouble, and raising cost.

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**MEANS**

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[Means for Solving the Problem] The image processing system by this invention for solving the above-mentioned object is equipped with the following configurations. That is, it is the image processing system which processes to the inputted image data and outputs to an output unit, and it has the means of communications which communicates to mutual [ said / output unit and mutual ], a receiving means receive the output unit information which shows the output unit of the image data of said output unit from this output unit through said means of communications, and a compression means divide and compress said inputted image data based on the output unit information which received with said receiving means.

[0008] Moreover, said compression means is preferably equipped with a storage means to memorize the compressed image data. Moreover, setting out about amplification of the image which outputs said output setting out at least preferably [ again ] / [ which transmits preferably the image data memorized by said storage means according to output setting out of said output unit and said output unit to this output unit through said means of communications ] reduction percentage, and image size is included.

[0009] Moreover, preferably, said inputted image data is divided per predetermined, and said compression means compresses it. Moreover, said predetermined unit is the number of pixels of the multiple of 8 preferably. Said compression means divides and compresses the this inputted image data for every number of pixels of said multiple of 8 to either [ at least ] the pixel direction of said inputted image data, or the direction of a line.

[0010] Moreover, said means of communications is an IEEE1394 serial bus preferably. The control approach of the image processing system by this invention for attaining the above-mentioned object is the control approach of the image processing system which is equipped with the following configurations, namely, processes them to the inputted image data, and outputs them to an output unit, and it has the receiving process which receives the output unit information which shows the output unit of the image data of said output unit from this output unit, and the pressing operation which divide said inputted image data and compress based on the output unit information received at said receiving process.

[0011] The image processing system by this invention for attaining the above-mentioned object is equipped with the following configurations. Namely, it is the image processing system which has the image processing system which processes to the inputted image data, and the output unit which outputs the image based on the image data processed with this image processing system. The means of communications which communicates mutually with said image processing system and said output unit, and said means of communications are minded. A 1st transfer means to transmit the output unit information which shows the output unit of the image data of said output unit to said image processing system, A compression means to divide and compress said inputted image data based on the output unit information notified with said advice means, It has a 2nd transfer means to transmit the image data compressed with said compression means according to output setting out of said output unit and said output unit to this output unit, through said means of communications.

[0012] The output unit by this invention for attaining the above-mentioned object is equipped with the following configurations. That is, it is the output unit which outputs the image based on the image data inputted from the image processing system, and has the means of communications

which communicates to mutual [ said / image processing system and mutual ], a transmitting means transmit the output unit information which shows the output unit of the image data of the output unit concerned to said image processing system through said means of communications, and a receiving means receive said output unit and the image data according to output setting out of the output unit concerned from said image processing system through said means of communications.

[0013]

[Embodiment of the Invention] Although the following operation gestalten explain the example which used the digital interface (D-I/F) for connection between a digital camera and a printer, in advance of this, IEEE1394 is explained as a representation technique of D-I/F employable with this operation gestalt.

Outline>> of the technique of <<IEEE1394 In order to communicate a video data, audio data, etc. with the appearance of noncommercial digital one VCR and a DVD player, it is real time and the support of the data transfer of high amount of information is needed. In order to transmit such video datas and audio data on real time and to transmit to the digital instrument of downloading to a personal computer (PC) \*\*\*\*, or others, the interface equipped with the required transfer facility in which a high-speed-data transfer is possible is needed. The interface developed from such viewpoints is IEEE1394 -1995 (it is called HighPerformance Serial Bus and a following 1394 serial bus).

[0014] Drawing 11 is drawing showing the example of a configuration of the network system constituted using a 1394 serial bus. This system is equipped with Devices A, B, C, D, E, F, G, and H, and it connects with the twisted-pair cable of a 1394 serial bus, respectively between A-B, between A-C, between B-D, between D-E, between C-F, between C-G, and between C-H. These device A-H is a personal computer, digital VTR, DVD, a digital camera, a hard disk, a monitor, a tuner, etc.

[0015] The connection type between each device enables mixture of a daisy chain method and node multipoint system, and high connection of a degree of freedom is possible for it. Moreover, each device has ID of a proper each one, and when each recognizes each other, it constitutes one network in the range connected by 1394 serial bus. Sequential connection of between each digital instrument is only made with one 1394 serial bus cable, respectively, and each device performs the role of junction and constitutes one network as a whole. Moreover, a 1394 serial bus has a Plug & Play function, and when it connects a cable to a device, it has the function to recognize recognition, a connection situation, etc. of a device automatically.

[0016] Moreover, in a system as shown in drawing 11 , when a certain device is deleted from a network or it is newly added, after performing bus reset automatically and resetting the network configuration till then, a new network is reconstructed. By this function, the configuration of that occasional network can always be set up and recognized.

[0017] Moreover, it has 100/200/400Mbps, a device with the transfer rate of a high order supports a low-ranking transfer rate, and a data transfer rate takes transposition. As data transfer mode, there are Asynchronous transfer mode which transmits asynchronous datas (Asynchronous data: henceforth Async data), such as a control signal, and Isochronous transfer mode which transmits synchronous data (Isochronous data: henceforth Iso data), such as a real time video data and audio data. After this Async data and Iso data transmit the cycle-start packet (CSP) which shows cycle initiation in each cycle (usually 1 cycle 125microsecond), giving priority to an Iso data transfer over Async data, within a cycle, it is intermingled and they are transmitted.

[0018] Drawing 12 is drawing showing the component of a 1394 serial bus. The 1394 serial bus consists of layer (hierarchy) structures as a whole. As shown in drawing 12 , there is a connector port where a connector is connected with the cable of a 1394 serial bus, and the physical layer and the link layer are positioned as hardware on it.

[0019] The hardware section is the part of a substantial interface chip, among those a physical layer performs coding, connector-related control, etc., and a link layer performs packet transfer, control of the cycle time, etc. The transaction layer of the firmware section manages the data which should be transmitted (transaction), and issues the instruction of Read, Write, and Lock. Serial bus management (management layer) is a part which performs management of the

connection situation of each device connected, or ID, and manages a network configuration. Even the above hardware and firmware are the configuration of the 1394 serial bus on parenchyma.

[0020] Moreover, the application layer of the software section changes with application software to be used, it is the part which specifies the data which carry on an interface, and the printer protocol, the AVC protocol, etc. are specified. The above is the configuration of a 1394 serial bus. Drawing 13 is drawing showing the address space in a 1394 serial bus. 64 bit addresses of each node proper are surely given to each device (node) connected to the 1394 serial bus. And by storing this address in ROM, while always being able to recognize the node address of oneself's or a partner, the communication link which specified the partner can also be performed. Addressing of a 1394 serial bus is a method according to IEEE1212 specification, 10 bits of the beginning are used for assignment of the number of a bus, and, as for address selection, the following 6 bits are used for assignment of a node ID number. And the remaining 48 bits become the address width of face given to the device, and can use it as an address space of a proper, respectively. In addition, 28 bits of the second half in 48 bits store discernment of each device, the information on assignment of a service condition, etc. as a field of proper data.

[0021] The above is the outline of the technique of a 1394 serial bus. Next, the part of the technique which can be called description of a 1394 serial bus is made to explain to a detail more. Electric specification>> of <<1394 serial bus Drawing 14 is the sectional view of a 1394 serial bus cable. By 1394 serial bus, the power-source line other than six pins, i.e., 2 sets of twisted pair signal lines, is prepared in the interconnection cable. Supply of power is attained at the device which does not have a power source by this, the device which carried out sag by failure. In addition, 8-40V, and a current are specified for the electrical potential difference of the power source which flows the inside of a power-source line as maximum current DC1.5A. In addition, it is constituted from the specification called DV cable by four pins which excluded the power source.

[0022] <<DS-Link coding>> Drawing 15 is drawing for explaining the DS-Link coding method of a data transfer format adopted by 1394 serial bus. By 1394 serial bus, the DS-Link (Data/Strobe Link) coding method is adopted. This DS-Link coding method is suitable for the high-speed serial data communication link, and that configuration needs two signal lines. It has the composition of sending a strobe signal to the twisted pair line from that of delivery and another side in the data which become main one in a twisted pair wire. In a receiving side, a clock is reproduced by taking the exclusive OR of this data that communicates, and a strobe. Since there is no need of sending the information which shows that it is an idle state when there are not circuit magnitude of Controller LSI being made small and data which should be transmitted further, since transfer efficiency being high and a PLL circuit become unnecessary as a merit using this DS-Link coding method compared with 8 / 10B conversion, it is mentioned by the ability making the transceiver circuit of each device into sleeping that reduction of power consumption can be aimed at etc.

[0023] Sequence>> of <<bus reset By 1394 serial bus, Node ID is given to each device (node) connected, and it is recognized as network configuration. When this network configuration has change (for example, when change arises and it is necessary to recognize new network configuration by the change in the number of nodes by the insert and remove of a node, ON/OFF of a power source, etc.), each node which detected change transmits a bus reset signal on a bus, and goes into the mode in which new network configuration is recognized. The detection approach of the change at this time is performed by detecting change of the bias voltage on a 1394 port substrate.

[0024] If a bus reset signal is transmitted from a certain node, BASURI set occurrence will be transmitted to a link layer, and the physical layer of each node will transmit a bus reset signal to other nodes at the same time it receives this bus reset signal. Bus reset is started after all nodes detect a bus reset signal eventually. Bus reset is started also by giving direct instruction to a physical layer by host control from a protocol etc., although started by cable \*\*\*\* which was described previously, and hard detection by the abnormalities in a network etc. Moreover, when bus reset starts, data transfer will be interrupted temporarily and data transfer will be kept waiting during processing of the bus reset concerned. And it is resumed under new network configuration after termination of bus reset. The above is the sequence of bus reset.

[0025] Sequence>> of <<node ID decision After bus reset, each node starts the actuation which

gives ID to each node, in order to build new network configuration. The general sequence to the node ID decision from bus reset at this time is explained using drawing 23 and the flow chart of 24 and 25.

[0026] Drawing 23 is a flow chart which shows the activity of a series of buses until it determines Node ID from BASURI set occurrence and can perform data transfer. First, in step S101, if it monitors continuously that bus reset occurs in a network and bus reset occurs by power-source ON/OFF of a node etc. here, it will move to step S102. At step S102, in order to know the connection situation of a new network from the condition that the network was reset, declaration of a parentage is made between each node by which direct continuation is carried out. In step S103, if it is judged that the parentage was determined among all nodes, it will progress to step S104 and the one root will be determined. In addition, the parentage of step S102 is declared and the root is not determined, either, until it determines a parentage among all nodes.

[0027] If the root is determined at step S104, in step S105, setting out of the node ID which gives ID to each node will be performed. In order of a predetermined node, setting out of Node ID is performed, and setting out is repeatedly performed until ID is given to all nodes (step S106). When it finishes setting ID as all nodes eventually, it means that new network configuration was recognized in all nodes. Therefore, processing progresses to step S107 from step S106, it will be in the condition that data transfer between nodes can be performed, and data transfer will be started.

[0028] And if it will be in the condition of this step S107, it goes into the mode which supervises that bus reset occurs again, and if bus reset occurs, setting out from step S101 to step S106 will be performed repeatedly. Although the above is explanation of the flow chart of drawing 23, the part from bus reset of the flow chart of drawing 23 to root decision and the procedure from after root decision to ID setting-out termination are explained in more detail with reference to drawing 24 and drawing 25. Drawing 24 is a flow chart explaining processing from the bus reset in each node to root decision. Moreover, drawing 25 is a flow chart which shows the procedure from after root decision to ID setting-out termination.

[0029] First, it explains with reference to drawing 24. If bus reset occurs in step S201, network configuration will once be reset and processing will progress to step S202. In addition, at step S201, it is always supervising that bus reset occurs. Next, in step S202, the flag which shows that it is a leaf (node) to each device as a first stage story of the activity which has a new appreciation of the connection situation of the reset network is set.

[0030] Next, in step S203, it investigates how many the port which he has [ each device ] is connected with other nodes. At step S204, in order to begin declaration of a parentage based on the number of ports, undefined (parentage is not determined) number of connections is investigated. immediately after bus reset -- number of ports = -- although it is the number of undefined ports, the undefined number of connections as which the parentage is determined and which is alike, follows and is detected at step S204 changes.

[0031] First, it is restricted to the leaf immediately after bus reset that a parentage can be declared first. It can know that it is a leaf by the check of the number of ports of step S203. That is, a parentage is [ the number of undefined ports of a leaf ] the thing of 1 in the phase of the undefined. In step S205, to the node connected to itself, a leaf is announced "He is a child and partners are parents", and ends actuation.

[0032] Since the node which the number of ports has recognized to be a branch with two or more at step S203 will call it undefined port number >1 at step S204 immediately after bus reset, it moves from it to step S206, and a flag called a branch is set. And it waits in order to receive "parents" by parentage declaration from a leaf at step S207. Other nodes which are leaves declare a parentage and a carrier beam branch checks the number of undefined ports of step S204 for it suitably at step S207. Here, it becomes possible to declare "Child (for himself to be a child)" of step S205 to the node connected to the port which remains if the number of undefined ports is 1. It waits in order to receive the "parents" from a leaf or other branches at step S207 again to a certain branch two or more, even if it checks the number of undefined ports by processing of step S204 after the 2nd times.

[0033] Eventually, when becoming zero as a result of the check of a leaf (although child

declaration could be made, since it did not operate quickly) of the number of undefined ports of step S204 on any one branch or an exception target Declaration of the parentage of the whole network is completed now, the flag of the root is set in step S208, and, as for the only node from which the number of undefined ports became zero (considering all as parents' port decision), the recognition as the root is made in step S209. Thus, from the bus reset shown in drawing 24 to declaration of the parentage in a network between all nodes is completed.

[0034] Below, the flow chart of drawing 25 is explained. First, since the information on the flag of each node called a leaf, a branch, and the root is set up by the sequence to drawing 24, it carries out based on this and classifies according to step S301, respectively. As an activity which gives ID to each node, it is from a leaf that ID can be set up first. A leaf  $\rightarrow$  branch  $\rightarrow$  setting out of ID is made from the young number (node number = 0) in order of the root.

[0035] In step S302, several Ns (N is the natural number) of the leaf which exists in a network are set up. Then, it is required that each leaf should give ID to the root in step S303. When there are two or more these demands, the root performs an Arbitration in step S304, gives an ID number to one node which won in step S305, and notifies to a negative beam node as a result of failure. The leaf which ID acquisition finished with failure in step S306 advances ID request again, and repeats the same activity.

[0036] The leaf which has acquired ID transmits ID information on the node to all nodes by broadcasting in step S307. After broadcasting of 1 node ID information finishes, in step S308, several Ns per \*\* of the remaining leaf are reduced. Here, in step S309, one or more, in a certain case, several Ns of this remaining leaf repeat the activity of the ID request from step S303, and carries out. And if all leaves broadcast ID information eventually, it will be set to  $N = 0$  in step S309, and will move to step S310 for ID setting out of a branch.

[0037] ID setting out of a branch as well as the time of a leaf is performed. First, several M (M is the natural number) of the branch which exists in a network in step S310 is set up. Then, it is required that each branch should give ID to the root as step S311. On the other hand, in step S312, the root performs an Arbitration and gives it to the degree of the number which it finished giving to a leaf from the young number sequentially from the branch which won. In step S313, the root notifies ID information or a failure result to the branch which advanced the demand. In step S314, the branch which ID acquisition finished with failure advances ID request again, and repeats the same activity.

[0038] It progresses to step S315 from the branch which has acquired ID, and ID information on the node is transmitted to all nodes by broadcasting. After broadcasting of 1 node ID information finishes, one several M of the remaining branch is reduced in step S316. here -- step S317 -- setting -- several [ of this remaining branch ] -- in a certain case, M repeats the activity of the ID request from step S311 one or more, and it is carried out until all branches broadcast ID information eventually. If all branches acquire Node ID, it will be set to  $M = 0$  in step S317, and ID acquisition mode of a branch will be completed.

[0039] Since the node which does not acquire ID information eventually is only the root after ending so far, the youngest number is set up with its ID number by the number which has not been given in step S318, and ID information on the root is broadcast as step S319. As shown in drawing 25, after determining a parentage above, a procedure until ID of all nodes is set up is completed.

[0040] Next, the network construction actuation at the time of the bus reset in the actual network shown in drawing 16 is explained as an example. Drawing 16 is drawing for explaining the network construction actuation at the time of bus reset. In drawing 16, direct continuation of Node A and the node C is carried out to the low order of Node B (root), direct continuation of the node D is further carried out to the low order of Node C, and it has a layered structure by which direct continuation of Node E and the node F was further carried out to the low order of Node D. The procedure of determining such a layered structure and a root node, and Node ID is explained below.

[0041] After bus reset is carried out, in order to recognize the connection situation of each node first, declaration of a parentage is made between the ports where direct continuation of each node is carried out. With this parent and child, a parents side can say that it becomes a high order by the layered structure, and a child side serves as low order. At drawing 16, Node A declared the

parentage to the beginning after bus reset. A parentage can be declared from the node (it is called a leaf) which has connection only in one port of a node fundamentally. Since it can know first that he has only connection of one port as for this, it recognizes that it is a network edge by this, and the parentage is determined from the node which operated early in it. In this way, the port of the side (between A-B the node A) which declared the parentage is set up with a child, and the port of the other party (node B) is set up with parents. In this way, between node A-B, it is decided between child-parents and node F-D between child-parents and node E-D that they will be child-parents.

[0042] the first [ further ] floor layer — it goes up and the parentage is shortly declared to the high order further for declaration of the parentage from other nodes one by one from the carrier beam thing among nodes (it is called a branch) with two or more connection ports. In drawing 16 , first, Node D is declaring the parentage to Node C, after determining a parentage between D-E and between D-F, and as a result, it is decided between node D-C that they will be child-parents.

[0043] The carrier beam node C is declaring the parentage to the node B by which declaration of the parentage from Node D is connected to another port. It is decided between node C-B by this that they will be child-parents. Thus, a layered structure like drawing 16 will be constituted and the node B which became parents in all the ports connected eventually will be determined as a root node. As for the root, only one exists during one network configuration.

[0044] In addition, although Node B was determined as the root node in this drawing 16 , if, as for this, the carrier beam node B is making Node A to parentage declaration parentage declaration to early timing to other nodes, it has moved from the root node to other nodes. That is, depending on the timing transmitted, every node may turn into a root node, and a root node is not necessarily regularity in the same network configuration, either.

[0045] If a root node is determined, next, it will go into the mode in which each node ID is determined. Here, all nodes notify their node ID to all other nodes (broadcasting function). [ who determined ] Self-ID information includes the information on its node number, the information on the location connected, the number of connections that it has, number of connections with connection, and the parentage of each port etc.

[0046] from the node (leaf) which has connection only in one port first as a procedure of assignment of a node ID number — it can start — the order from this inside — node number = — it is assigned with 0, 1, and 2 —. The node which gained Node ID transmits the information containing a node number to each node by broadcasting. It is recognized by this that the ID number is "finishing [ assignment ]."

[0047] If all leaves finish acquiring the self-node ID, the node ID number which next moved to the branch and followed the leaf will be assigned to each node. Node ID information is broadcast one by one like a leaf from the branch to which the node ID number was assigned, and, finally a root node broadcasts self-ID information. That is, the root always owns the greatest node ID number.

[0048] Assignment of the node ID of the whole layered structure finishes as mentioned above, network configuration is reconstructed, and the initialization activity of a bus is completed.

<<Arbitration>> By 1394 serial bus, the Arbitration (mediation) of a bus royalty is surely performed in advance of data transfer. Since a 1394 serial bus is a logical bus mold network as each device connected according to the individual tells this signal in a network to all devices by relaying the transmitted signal, respectively, the Arbitration is required of the semantics which prevents the collision of a packet. Only one node can transmit to a certain time amount by this.

[0049] Drawing 17 is drawing explaining the Arbitration in a 1394 paper real bus. Especially (a) of drawing 17 shows the flow of a bus activity demand, and (b) of drawing 17 shows the flow of bus licence. If an Arbitration starts, one or two or more nodes will emit a demand of a bus royalty toward a parent node, respectively. Node C and Node F of drawing 17 (a) are a node which has emitted the demand of a bus royalty. A carrier beam parent node ( drawing 17 the node A) emits a demand of a bus royalty for this toward a parent node further (it acts as intermediary). This demand is sent to the root which arbitrates eventually.

[0050] It decides whether a carrier beam root node (node B) makes a bus use a bus activity demand for which node. This mediation can perform only a root node and the licence of a bus is given to the node which won by mediation. By (b) of drawing 17 , licence is given to Node C and it

is shown that the activity demand of Node F was refused. It tells that delivery and a demand were refused by the Arbitration in DP (data prefix) packet to the negative beam node. The bus activity demand of the node by which the demand was refused is kept waiting to a next Arbitration.

[0051] The node which won the Arbitration as mentioned above and obtained the licence of a bus can start a data transfer henceforth. Here, a series of flow of an Arbitration is explained with reference to flow chart drawing 26 . Drawing 26 R> 6 is a flow chart showing the procedure of an Arbitration. In order for a node to be able to start data transfer, it is required for a bus to be an idle state. In order to complete the data transfer currently performed previously and to recognize that a current bus is idle status, it is judged that each node can start a transfer of it by going through the predetermined idle-time gap length (example . subaction gap) set up according to the individual by each transfer mode.

[0052] In step S401, it judges whether the predetermined gap length according to data transmitted, respectively, such as Async data and Iso data, was obtained. Since a demand of a bus royalty required in order to start a transfer cannot be performed unless predetermined gap length is obtained, it waits until predetermined gap length is obtained. If gap length predetermined at step S401 is obtained, it judges whether there are any data which should be transmitted in step S402, and if it is, it will progress to step S403.

[0053] At step S403, in order to carry out data transfer, a demand of a bus royalty is emitted to the root so that a bus may be secured. Transfer of the signal showing the demand of a bus royalty at this time is eventually sent to the root, relaying each device in a network, as shown in (a) of drawing 17 . On the other hand, when there are no data transmitted at step S402, it stands by as it is. Next, in step S404, a root node receives the bus activity demand published at step S403. And in step S405, the root investigates the number of nodes which advanced the activity demand. When the number of nodes which advanced the activity demand by step S405 is 1 (the node which advanced the royalty demand is one), the next bus licence will be given to the node. On the other hand, in step S405, if it is node number >1 (the node which advanced the activity demand is plurality), the root will perform mediation which determines the node which gives licence in step S406 as one. It has the composition that access is equally granted so that this mediation may be fair and only the nodes same each time may not obtain authorization (fair Arbitration).

[0054] Next, in step S407, selection divided into one node which the root arbitrated out of two or more nodes which advanced the activity demand by step S406, and obtained licence, and the node of others which were beaten is performed. one node which was arbitrated and obtained licence here, or step S405 -- setting -- the number of activity demand nodes -- the root sends an enabling signal to the node which obtained licence without mediation by =1 to the node as step S408. The node which acquired the enabling signal carries out transfer initiation of the data (packet) which should be transmitted immediately after receiving. Moreover, mediation of step S406 is lost, and in step S409, DP (data prefix) packet which shows Arbitration failure is sent from the root, and to it, the node which received this stands by until return and predetermined gap length are obtained to step S401 by the node to which a bus activity was not permitted, in order to advance the bus activity demand for transmitting again.

[0055] The above is the flow of the Arbitration by the 1394 serial bus.

<< -- asynchronous (Asynchronous, asynchronous) transfer>> -- an asynchronous transfer is asynchronous transmission. Drawing 18 is drawing showing the time transition state in an asynchronous transfer. The subaction gap of the beginning of drawing 18 shows the idle state of a bus. When this idle time becomes constant value, it judges that the node which wishes to transmit can use a bus, a bus activity demand is published, and the Arbitration for bus acquisition is performed.

[0056] If the licence of a bus is obtained by the Arbitration, a data transfer will be performed in a packet format next. A transfer completes the node which received the data concerned after data transfer by returning ack of a receiving result to the transmitted data (return code for the confirmation of receipt) after a short gap called ack gap, and answering, or sending a response packet. ack consists of 4 bits information and a 4-bit checksum, and a transmitting agency node is immediately returned including the information whether they are a success, a busy condition, and pending status.

[0057] Next, the packet format of an asynchronous transfer is explained. Drawing 19 is drawing showing the example of the packet format of an asynchronous transfer. There are data division and a header unit other than the data CRC for error corrections in a packet. The object node ID, the source node ID, transfer data die length, various codes, etc. as shown in drawing 19 are written in a header unit, and a transfer is performed. Moreover, an asynchronous transfer is the communication link of 1 to 1 to a partner node from a self-node. Although the packet transmitted from the source node spreads round each node in a network, since things other than the address addressed to themselves are disregarded, only one node of the destination will read. The above is explanation of an asynchronous transfer.

[0058] <<isochronous (Isochronous, synchronization) transfer>> An isochronous transfer is synchronous transmission. Especially this isochronous transfer that can be said to be the greatest description of a 1394 serial bus is the transfer mode suitable for the data transfer which needs the real time transfer of image data, multimedia data called voice data. Moreover, as for this isochronous transfer, data are uniformly transmitted to all other nodes from one node of the source by the broadcasting function to the asynchronous transfer (asynchronous) having been a transfer of 1 to 1.

[0059] Drawing 20 is drawing in an isochronous transfer showing a time transition state. An isochronous transfer is performed for every fixed-on bus time amount. This time interval is called an isochronous cycle. The isochronous cycle time is 125 microseconds. The cycle-start packet is bearing the role which shows the start time of each of this cycle and performs timing of each node. The node called a cycle master transmits a cycle-start packet, and after the data transfer termination in the cycle in front of one, after passing through a predetermined idle period (subaction gap), it transmits the cycle-start packet which tells initiation of this cycle. The time interval to which this cycle-start packet is transmitted is set to 125 microseconds.

[0060] Moreover, as it was indicated in drawing 20 as Channel A, Channel B, and Channel C, when two or more sorts of packets can give Channel ID into 1 cycle, respectively, it can distinguish and transmit. By this, the real time transfer between two or more nodes is simultaneously possible, and he incorporates only the data of the channel ID needed by the node which receives. This channel ID does not express the address of a transmission place, and has given the logical number to data. Therefore, transmission of a certain packet will be transmitted by broadcasting which spreads round all other nodes from the transmitting agency node of one.

[0061] In advance of packet transmission of an isochronous transfer, an Arbitration is performed like an asynchronous transfer. However, since it is not the communication link of 1 to 1 like an asynchronous transfer, ack (reply code for the confirmation of receipt) does not exist in an isochronous transfer. Moreover, it was shown in drawing 20 . iso gap (isochronous gap) expresses the idle period required in order to recognize it as a bus being idle status before performing an isochronous transfer. If this predetermined idle period passes, it can judge that the bus is vacant as for a node to perform an isochronous transfer, and the Arbitration before a transfer can be performed.

[0062] Below, the packet format of an isochronous transfer is explained. Drawing 21 is drawing showing the example of the packet format of an isochronous transfer. There is a header unit other than the data CRC for data division and error corrections in various kinds of packets divided into each channel, respectively. A transfer data length as shown in drawing 21 , channel NO., other various codes, the header CRC for error corrections, etc. are written in the header unit, and a transfer is performed. The above is explanation of an isochronous transfer.

[0063] <<bus cycle>> An isochronous transfer and an asynchronous transfer can be intermingled in the transfer on a actual 1394 serial bus. Drawing 22 is drawing showing the signs of time transition of the transfer condition on a bus that the isochronous transfer and the asynchronous transfer were intermingled. Priority is given to an isochronous transfer over an asynchronous transfer, and it is performed. The reason is gap length (isochronous gap) shorter than the gap length (subaction gap) of an idle period required in order to start an asynchronous transfer after a cycle-start packet, and is because an isochronous transfer can be started. Therefore, an isochronous transfer will be given priority to and performed from an asynchronous transfer.

[0064] In the general bus cycle shown in drawing 22 , a cycle-start packet is transmitted to each

node from a cycle master at the time of the start of cycle #m. By this, after performing time-of-day adjustment by each node and waiting for a predetermined idle period (isochronous gap), the node which should perform an isochronous transfer performs an Arbitration and starts a packet transfer. In drawing 22, the isochronous transfer of Channel e, Channel s, and the channel k is carried out at order.

[0065] An asynchronous transfer can be performed, if all isochronous transfers in cycle #m are completed after performing actuation from this Arbitration to a packet transfer repeatedly by the channel to which it is given. When the idle time reaches the subaction gap which can be transmitted asynchronously, it is judged that it can move from a node to perform an asynchronous transfer to activation of an Arbitration. However, the period which can perform an asynchronous transfer is restricted when the subaction gap for starting an asynchronous transfer from after isochronous transfer termination before the time amount (cycle synch) which should transmit the following cycle-start packet is obtained.

[0066] In cycle #m of drawing 22, 2 packet (packet 1, packet 2) transfer of the asynchronous transfer (ack is included) is carried out after that with the isochronous transfer for three channels. Since after this asynchronous packet 2 results in the time amount (cycle synch) which should start a cycle m+1, the transfer by cycle #m is finished even here.

[0067] However, supposing it results in the time amount (cycle synch) which should transmit the following cycle-start packet during asynchronous or synchronous transmission actuation, it is not interrupted by force, but after waiting for the idle period after the transfer is completed, the cycle-start packet of degree cycle will be transmitted. That is, when one cycle continues 125 microseconds or more, degree cycle presupposes that much that it was shortened from 125 microseconds of criteria. Thus, on the basis of 125 microseconds, an isochronous cycle is exceeded and can be shortened. However, if an isochronous transfer is the \*\* cycle need in order to maintain a real-time transfer, it may surely be performed, and an asynchronous transfer may be turned to the cycle after a degree by having shortened the cycle time. It is managed by the cycle master also including such delay information.

[0068] < — operation — a gestalt — one — > — this invention — operation — a gestalt — one —  
— \*\*\*\* — an image processing system — an output unit — connecting — having — the — an  
image processing system — processing — having had — image data — being based — an image —  
— an output unit — outputting — an image processing system — setting — an image processing  
system — \*\*\*\*\* — a digital camera — an output unit — \*\*\*\*\* — a printer — having  
constituted — drawing 4 — R — > — four — being shown — as — an image processing system —  
— an example — mentioning — explaining .

[0069] First, the functional configuration and its actuation of a digital camera are explained using drawing 2. Drawing 2 is the block diagram showing the functional configuration of the digital camera of the operation gestalt 1 of this invention. In addition, the case where the image corresponding to the image data shown in drawing 1 is recorded is mentioned as an example, and is explained here.

[0070] First, image formation of the image obtained from a lens system 21 is carried out on the 22nd page of a CCD component. The analog signal acquired from the CCD component 22 is changed into a digital signal by the A/D-conversion section 23. It is transmitted to the image-processing section 24, and the changed digital signal is changed into the image data to which image processings, such as color transform processing, edge enhancement processing, and gamma correction processing, were performed. Next, image data is transmitted to the image transformation section 25. In the image transformation section 25, for every several pixels recordable [ with one scan of the recording head of a printer ], it is divided, and JPEG compression is carried out for every divided image data, and image data is recorded on the data-logging section 26.

[0071] In addition, management of record in the data-logging section 26 of image data is performed based on the address of the data-logging section 26. For example, when image data A for the record medium of one sheet used for record of a printer is divided into three image data A1 and A2 and A3 and JPEG compression is carried out, each start address of image data A1 and A2 and the data-logging section 26 on which A3 is recorded is managed by the address Management

Department in the data-logging section 26 (un-illustrating).

[0072] The above processings are performed also to image data B and image data C. In this case, it is divided into image data B1, B-2, and B3, JPEG compression is carried out, image data B is recorded on the data-logging section 26, it is divided into image data C1, C2, and C3, JPEG compression is carried out, and image data C is recorded on the data-logging section 26. Next, the functional configuration and actuation of the printer connected to the above-mentioned digital camera are explained using drawing 3.

[0073] In addition, the printer of the operation gestalt 1 presupposes that it is the ink jet printer which carried the recording head by the ink jet method, and a recording head presupposes that 64 nozzles are arranged, respectively in the scanning direction (pixel direction) and a direction (the direction of a line) vertical to the scanning direction of a recording head, i.e., the conveyance direction of a record medium. Moreover, each nozzle corresponds to 1 pixel of image data, and a record medium presupposes that the cut sheet of A4 size is used.

[0074] Drawing 3 is the block diagram showing the functional configuration of the printer of the operation gestalt 1 of this invention. A user first chooses the image data recorded by how many the image data recorded on the data-logging section 26 in a digital camera is recorded or which image data is recorded, and the printer by the interface section 31 on a printer. In addition, although not explained in full detail, as long as the selection of image data recorded by the printer has a display in a digital camera, it may display and choose the image data currently recorded on the data-logging section 26 on the display, and may choose it using the index print of the image data recorded on the data-logging section 26.

[0075] Here, the case where one image data A currently recorded on the data-logging section 26 is recorded on the record medium of A4 size is mentioned as an example, and is explained. If the image data (image data A) recorded by the printer is chosen, a printer will transmit the request signal for obtaining image data from the interface section 31 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits one of the image data which divided image data A and carried out JPEG compression to a printer so that it may reply to the request signal.

[0076] In addition, as mentioned above, the division unit which divides image data A is determined by several pixels recordable by one scan of the recording head of a printer. For example, since the number of the nozzles of the pixel direction of a recording head (pixel number) is 64 when image data A is 832 pixel (line) x 640 pixel (pixel), image data A is divided per 832 pixel (line) x 64 pixels (pixel). That is, JPEG compression of each is carried out and image data A is recorded on the data-logging section 26, after being divided into A9 and 10 of A10, image data A1, A2, A3, —,.

[0077] Moreover, before the number of pixels recordable by one scan of a recording head transmits to a printer the image data which a user sets up from the interface section 27 of a digital camera beforehand, or is recorded on the data-logging section 26 of a digital camera, it may be made a configuration which a printer notifies to a digital camera. moreover — or you may set up as a default beforehand like the operation gestalt 3 mentioned later.

[0078] Next, the image data (for example, image data A1) which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 32. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 32 is carried out. As for the image data A1 by which JPEG thawing was carried out, color transform processing and binary-ized processing are made by the print image-processing section 33. The image data A1 made binary is transmitted to the record position control processing section 34, and the location which should record on a record medium is managed.

[0079] In addition, position control in the record position control processing section 34 is performed by controlling the write-in location of the buffer memory 36 corresponding to the image data made binary. Next, it is transmitted to the head actuation signal transformation section 35, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 36. And based on the position control by the record position control processing section 34, a record signal is transmitted to printer engine 37 one by one, and the image based on

the record signal is recorded on a record medium.

[0080] The above is a record procedure by one scan of the recording head of the printer of the operation gestalt 1. If record by one scan of a recording head is completed, in order to obtain image data required for record of 1 scan of the following recording head from a digital camera by the interface section 31 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A2) required for one scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to the image data A2 which received from the digital camera and by which JPEG compression was carried out is recorded on a record medium by the same record procedure mentioned above.

[0081] If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. Next, the record procedure in the case of recording two or more images on the scanning direction of a recording head is explained. In addition, in order to simplify explanation, the image data which a printer chooses and to record shall be set up so that the image A corresponding to image data A and the image B corresponding to image data B may be recorded on the scanning direction of a recording head, as image data A mentioned above, image data A, and image data B of the same size are chosen and it is shown in drawing 6.

[0082] First, image data A corresponding to the image A inputted from the digital camera and image data B corresponding to Image B are the same record procedures mentioned above, and JPEG compression is divided and carried out for every several pixels recordable by one scan of a recording head, and they are recorded on the data-logging section 26. Then, the request signal of image data more nearly required for record than a printer is transmitted to a digital camera. The digital camera which received the request signal from the printer transmits to a printer the image data A1 by which JPEG compression was carried out, then the image data B1 by which JPEG compression was carried out as image data required for one scan of the recording head of the beginning of a printer.

[0083] And a printer receives the image data A1 by which JPEG compression was carried out from a digital camera, and once stores it in the position of buffer memory 36 through an above-mentioned record procedure. Then, the image data B1 by which JPEG compression was carried out is received from a carrier digital camera, and it once stores in a different location from the location where the image data A1 of buffer memory 36 is stored by the same record procedure. If image data A1 and image data B1 are stored in buffer memory 36, based on the position control of the record position control processing section 34, the image which is transmitted to printer engine 37 one by one, and corresponds will be recorded on a record medium.

[0084] If it carries out one by one to image data A10 and image data B10 and image data A2, image data B-2, image data A3, image data B3, —, the image corresponding to image data A10 and image data B10 are recorded on a record medium, record of the image A corresponding to image data A and the image B corresponding to image data B will complete the above record procedures.

[0085] In addition, although the operation gestalt 1 explained the configuration which outputs the image which connects to a printer the image data currently recorded on the data-logging section 26 of a digital camera, and corresponds, it cannot be overemphasized that the image which connects with a personal computer and corresponds to drawing 5 so that it may be shown can be outputted to the monitor of a personal computer. Moreover, although the case where two images A and Image B were put in order and recorded on the scanning direction of a recording head as an example which records two or more images was explained, it is also possible to put in order and record two or more images on the scanning direction of a recording head. Furthermore, it is also possible to put in order and record two or more images in the scanning direction of a recording head as shown in drawing 7, and the conveyance direction of a record medium.

[0086] Furthermore, as a compression method of the image data corresponding to the image inputted into the digital camera, although the JPEG compression method is used, it is not limited to this. According to the operation gestalt 1, as explained above, the image data inputted from the

digital camera is divided for every number of pixels recordable by one scan of the recording head of a printer, and since the divided image data is received and recorded for every scan of a recording head, \*\* which performs efficiently the send action of the image data from a digital camera to a printer and record actuation of a printer is made. Consequently, the total throughput of an image processing system can be improved.

[0087] Moreover, since it records by carrying out sequential reception of the image data required for one scan of the recording head of a printer, the buffer memory 36 with the memory capacity for memorizing the image data of the whole image recorded on a record medium is not needed. Consequently, the storage capacity of buffer memory 36 can be reduced.

With the <operation gestalt 2> operation gestalt 2, a digital camera and a printer are connected and the image processing system which expands or reduces the size of the image corresponding to the image data inputted with the digital camera, and is recorded by the printer is explained as an operation gestalt 2.

[0088] In addition, since it is the same as that of drawing 1 of the operation gestalt 1 about the functional configuration and actuation of the digital camera of the operation gestalt 2, the detail is omitted here. Next, the functional configuration and actuation of the printer of the operation gestalt 2 are explained using drawing 8. Drawing 8 is the block diagram showing the functional configuration of the printer of the operation gestalt 2 of this invention.

[0089] In addition, the recording head of the printer of the operation gestalt 2 presupposes that the same thing as the recording head of the printer of the operation gestalt 1 is used. First, by the interface section 31 on a printer, a user sets up the scale factor of the size of the image to record, amplification, or a cutback while choosing the image data recorded by how many the image data recorded on the data-logging section 26 in a digital camera is recorded or which image data is recorded, and the printer. In addition, although not explained in full detail, as long as the selection of image data recorded by the printer and setting out of size have a display in a digital camera, they may display and choose the image data recorded on the data-logging section 26 on the display, and may choose it using the index print of the image data recorded on the data-logging section 26.

[0090] Here, the case where expand image data A of the operation gestalt 1 mentioned above twice, and one sheet is recorded on the record medium of A4 size is mentioned as an example, and is explained. If selection and its size to record are set up for the image data (image data A) recorded by the printer, a printer will transmit the request signal for obtaining image data from the interface section 81 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits to a printer the image data A1 which divided image data A and carried out JPEG compression so that it may reply to the request signal.

[0091] The image data A1 which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 82 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 1 (83). The image data stored in buffer memory 1 (83) is the print image-processing section 84, and conversion of image size is performed. since it is here set up so that image data may be expanded twice — the inside of buffer memory 1 (83) to the image data A1 (832 pixels x 64 pixels), and 832pixelx — reading appearance of the image data for 32 pixels is carried out, and it expands to 1664 pixel x64 pixel image data by well-known scale-factor transform processing.

[0092] And color transform processing and binary-ized processing are made to the expanded image data. The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed. In addition, position control in the record position control processing section 85 is performed by controlling the write-in location of the buffer memory 2 corresponding to the image data made binary (87). And it is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87). And based on the position control by the record position control processing section 85, a record

signal is transmitted to printer engine 88 one by one, and the image based on the record signal is recorded.

[0093] next, remaining 832pixels of the image data A1 stored in buffer memory 1 (83) -- the image data for 32 pixels is recorded on the location which should be recorded on a record medium with the same procedure. If all the image data stored in buffer memory 1 (83) is recorded, a printer will transmit the request signal of the following image data A2 to a digital camera. And if the following image data A2 is received from a digital camera, the image corresponding to image data A2 will be recorded on the location which should record on a record medium with the same procedure performed to image data A1. If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. Next, the case where reduce image data A to 1/2, and one sheet is recorded on the record medium of A4 size is explained.

[0094] If selection and its size to record are set up for the image data (image data A) recorded by the printer, a printer will transmit the request signal for obtaining image data from the interface section 81 to a digital camera. A request signal is transmitted to the interface section 27 of a digital camera. And a digital camera transmits to a printer the image data A1 which divided image data A and carried out JPEG compression so that it may reply to the request signal. The image data A1 which the printer received from the digital camera and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 82 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 83. The image data stored in buffer memory 1 (83) is the print image-processing section 84, and conversion of image size is performed. Here, since it is set up so that image data may be reduced to 1/2, image data A1 (832 pixels x 64 pixels) is read from buffer memory 1 (83), and it reduces to 416 pixel x32 pixel image data by well-known scale-factor transform processing. And color transform processing and binary-ized processing are made to the reduced image data. The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed. It is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87).

[0095] Next, with the same procedure, image data A2 is received from a digital camera, and the record signal corresponding to image data A2 is stored behind the location where the record signal corresponding to the image data A1 of buffer memory 2 (87) is stored. image data A1 and A2 -- if it is alike, respectively and the record signal of two corresponding is stored in buffer memory 2 (87), each record signal will be transmitted to printer engine 88 one by one based on the position control by the record position control processing section 85, and the image based on the record signal will be recorded on a record medium.

[0096] It is a record procedure by one scan of a recording head in case the above reduces and records image data on 1/2. After record by one scan of a recording head is completed, in order to obtain image data required for record of 1 scan of the following recording head from a digital camera by the interface section 81 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A3, A4) required for the scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to image data A3 and A4 which received from the digital camera and by which JPEG compression was carried out is recorded on the location which should record on a record medium by the same record procedure mentioned above. If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A10 is recorded on a record medium, record of the image corresponding to image data A will be completed. In addition, although the case where it expands and records twice as size of image data to record, and the case where it reduced and recorded on 1/2 were mentioned as the example and the operation gestalt 2 explained them, it expands by 3 times and 4 times, and when reducing and

recording record, 1/3 time, and 1/4 time, it can respond in the same procedure. Moreover, although the case where one image was recorded on a record medium was explained here, as the operation gestalt 1 explained, it is also possible to record two or more images on a record medium. As explained above, also when according to the operation gestalt 2 changing the size of the image data inputted with the digital camera and recording the image corresponding to the changed image data by the printer, the same effectiveness as the operation gestalt 1 can be acquired.

[0097] With the <operation gestalt 3> operation gestalt 1 and the operation gestalt 2, although it was the configuration of inputting several pixels which are the units which divide the image data inputted from the digital camera from a user or a printer, the default beforehand determined in this may be used. The digital camera and printer by which several pixels which are the units to divide are hereafter determined by the default are connected, and the image processing system which records the image corresponding to the image data inputted with the digital camera by the printer is explained as an operation gestalt 3.

[0098] In addition, since it is the same as that of the operation gestalt 2 about the functional configuration and actuation of the digital camera of the operation gestalt 3, and a printer, the detail is omitted here. Moreover, generally the number of nozzles of the recording head of a printer turns into a multiple of eight on the problem of data control. namely, . Several pixels which become recordable by one scan of a recording head serve as a multiple of 8. Therefore, several pixels which are the units which divide the image data beforehand determined within the digital camera are set as the multiple of 8. Moreover, it is desirable to set several pixels as the multiple of 8 also from the compression unit of the JPEG compression to image data being 8 pixel x8 pixel.

[0099] Here, within a digital camera, several pixels which are the units which divide the image data determined beforehand are 32, and the case where one image data A of the operation gestalt 1 mentioned above is recorded on the record medium of A4 size is mentioned as an example, and is explained. first — since the size of image data A currently recorded on the data-logging section 26 is 832 pixel x640 pixel in a digital camera — image data A — 832pixelx — the image data A1 and A2 in every 32 pixels, and — it is divided into 20 of A20, JPEG compression is carried out, and it is recorded on the data-logging section 26. And if the request signal for obtaining image data from the interface section 31 of a printer is transmitted to a digital camera, a digital camera will transmit several pixels (here 32) which are the division units of image data to a printer. A printer measures the several pixels and several pixels recordable by one scan of a recording head, and determines the number of the image data which can receive from a digital camera at a time and by which JPEG compression was divided and carried out based on the comparison result. (With the operation gestalt 3, since several pixels recordable by one scan of a recording head are 64, the image data whose number is two and which was divided and compressed is needed.)

Then, a printer receives the image data A1 by which JPEG compression was carried out from a digital camera, and the image data A1 which received and by which JPEG compression was carried out is transmitted to the JPEG thawing processing section 82. And JPEG thawing of the image data A1 by which JPEG compression was carried out in the JPEG thawing processing section 32 is carried out. The image data A1 by which JPEG thawing was carried out is stored in buffer memory 1 (83). Then, the image data A2 by which JPEG compression was carried out is received from a digital camera, and it stores in buffer memory 1 (83) in the same procedure. Color transform processing and binary-ized processing are made to the image data stored in the buffer memory 1 (83). The image data made binary is transmitted to the record position control processing section 85, and the location which should record on a record medium is managed.

[0100] Next, it is transmitted to the head actuation signal transformation section 86, and the image data by which position control was carried out and which was made binary is changed into the record signal for operating a recording head. Next, a record signal is once stored in buffer memory 2 (87). And based on the position control by the record position control processing section 85, a record signal is transmitted to printer engine 88 one by one, and the image based on the record signal is recorded on a record medium.

[0101] It is a record procedure by one scan of a recording head in case several pixels whose above is the units which divide the image data in a digital camera are determined beforehand. After record by one scan of a recording head is completed, in order to obtain image data required for

record of 1 scan of the following recording head from a digital camera by the interface section 81 of a printer again, a request signal is transmitted to a digital camera. In a digital camera, if a request signal is received from a printer, the image data (here image data A3, A4) required for the scan of the next recording head of a printer by which JPEG compression was carried out will be transmitted to a printer. And the image corresponding to image data A3 and A4 which received from the digital camera and by which JPEG compression was carried out is recorded on the location which should record on a record medium by the same record procedure mentioned above.

[0102] If the above record procedures are performed one by one to the divided image data which was compressed and the image corresponding to image data A20 is recorded on a record medium, record of the image corresponding to image data A will be completed. In addition, several pixels which are the units which divide the image data in a digital camera with the operation gestalt 3 are although it was determined beforehand 32. If it is the multiple of 8, it will not be restricted to this.

[0103] As explained above, even when several pixels which are the units which divide the image data in a digital camera are determined beforehand according to the operation gestalt 3, image data required for one scan of a recording head can be received by measuring the several pixels and several pixels recordable by one scan of the recording head of a printer. Therefore, also in such a case, the same effectiveness as the operation gestalt 1 can be acquired.

[0104] In addition, the decision approach of several pixels which are the division units which divide image data within the digital camera of the image processing system of this invention is divided roughly into two, the approach of acquiring from several pixels recordable by the input from a user, or one scan of the recording head of a printer, and the approach of determining beforehand within the digital camera. If its attention is paid to this viewpoint, the operation gestalten 1 and 2 correspond to the approach of gaining several pixels which are division units from the input or printer from a user, and the approach the operation gestalt 3 determines several pixels beforehand within the digital camera.

[0105] Then, the processing performed with the image processing system in the operation gestalten 1 and 2 as an outline of the processing performed with the image processing system of this invention and the processing performed with the image processing system in the operation gestalt 3 are explained using the flow chart of drawing 9 and drawing 1010. First, the outline of the processing performed with the image processing system in the operation gestalten 1 and 2 is explained using drawing 9.

[0106] Drawing 9 is a flow chart which shows the outline of processing of the image processing system of the operation gestalten 1 and 2 of this invention. First, the number of pixels recordable by one scan of a recording head is gained from the input or printer from a user at step S101 to a digital camera side. Next, according to the gained number of pixels, image data is divided at step S202. Next, JPEG compression of the divided image data is carried out, and it records on the data-logging section 26.

[0107] boil selection of the image data made to output to a printer side at step S104, and setting out of image size interface section 31 (or interface section 81) — it \*\*\*\*\*. The image data by which JPEG compression was carried out from the digital camera at step S105 according to the input from the interface section 31 (or interface section 81) is inputted. At step S106, JPEG thawing of the inputted image data by which JPEG compression was carried out is carried out. After performing a required image processing at step S107 to the image data by which JPEG thawing was carried out, it records with printer engine 37 (or printer engine 88).

[0108] Next, the outline of the processing performed with the image processing system in the operation gestalt 3 is explained using drawing 10. Drawing 10 is a flow chart which shows the outline of processing of the image processing system of the operation gestalt 3 of this invention. First, image data is divided according to the predetermined number of pixels which is the division unit of the image data beforehand determined as the digital camera side at step S201. Next, at step S202, JPEG compression of the divided image data is carried out, and it records on the data-logging section 26.

[0109] The information which shows from a printer the predetermined number of pixels which is the division unit of image data at step S203 is inputted into a printer side. Step S204 compares the inputted predetermined number of pixels, and the number of pixels recordable by one scan of

the recording head of a printer. The image data by which JPEG compression was carried out from the digital camera at step S205 based on the comparison result is inputted. At step S206, JPEG thawing of the inputted image data by which JPEG compression was carried out is carried out. After performing a required image processing at step S207 to the image data by which JPEG thawing was carried out, it records with printer engine 88.

[0110] Since the image data by which JPEG compression of the image by which partial division was carried out within the digital camera was carried out is transmitted to a printer by needed image data according to the operation gestalt 1 – the operation gestalt 3 as explained above, the time amount of a transfer can be shortened. Moreover, since image data is received and recorded for every number of pixels recordable by one scan of the recording head of a printer, it becomes possible to reduce the storage capacity of buffer memory greatly compared with the former. What is necessary is to face acquiring the output unit information which shows the output unit of the image data of an output unit, and just to obtain in the operation gestalt of this invention, by communicating the asynchronous packet shown in drawing 22 . Moreover, it may face compressing the inputted image data based on this output unit information, and you may receive by the isochronous packet which shows this image data to drawing 22 , and may receive by the asynchronous packet. Receiving by the isochronous packet is desirable in respect of a receiving rate. Moreover, receiving by the asynchronous packet is desirable in respect of the soundness of received data. Moreover, although the IEEE1394 serial bus was mentioned as the example and this operation gestalt explained it, this invention may not be limited to this, other interfaces, for example, the interface called USB, are sufficient as it, and the interface of the other method is sufficient as it.

[0111] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device. Moreover, it cannot be overemphasized by the object of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained.

[0112] In this case, the function of the gestalt of operation which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention. As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0113] Moreover, it cannot be overemphasized that it is contained also when the function of the gestalt of operation which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized. Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional add-in board inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

## **\* NOTICES \***

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3. In the drawings, any words are not translated.

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## **DESCRIPTION OF DRAWINGS**

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### **[Brief Description of the Drawings]**

- [Drawing 1] It is drawing for explaining record actuation of the printer of this invention.
- [Drawing 2] It is the block diagram showing the functional configuration of the digital camera of the operation gestalt 1 of this invention.
- [Drawing 3] It is the block diagram showing the functional configuration of the printer of the operation gestalt 1 of this invention.
- [Drawing 4] It is drawing showing the configuration of the image processing system which consists of the digital cameras and printers of the operation gestalt 1 of this invention.
- [Drawing 5] It is drawing showing the configuration of the image processing system which consists of the digital cameras and personal computers of the operation gestalt 1 of this invention.
- [Drawing 6] It is drawing for explaining the example of record of the printer of the operation gestalt 1 of this invention.
- [Drawing 7] It is drawing for explaining record actuation of the printer of the operation gestalt 1 of this invention.
- [Drawing 8] It is the block diagram showing the functional configuration of the printer of the operation gestalt 2 of this invention.
- [Drawing 9] It is the flow chart which shows the outline of processing of the image processing system of the operation gestalten 1 and 2 of this invention.
- [Drawing 10] It is the flow chart which shows the outline of processing of the image processing system of the operation gestalt 3 of this invention.
- [Drawing 11] It is drawing showing 1 operation gestalt of the communication system using an IEEE1394 serial bus.
- [Drawing 12] It is drawing showing the layered structure of an IEEE1394 serial bus.
- [Drawing 13] It is drawing showing the address of an IEEE1394 serial bus.
- [Drawing 14] It is the sectional view of an IEEE1394 serial bus.
- [Drawing 15] It is drawing for explaining a DS-Link coding method.
- [Drawing 16] It is drawing showing the parentage between nodes.
- [Drawing 17] It is drawing showing the process of an Arbitration.
- [Drawing 18] It is drawing showing subaction in an Asynchronous transfer.
- [Drawing 19] It is drawing showing the packet structure in an Asynchronous transfer.
- [Drawing 20] It is drawing showing subaction in an Isochronous transfer.
- [Drawing 21] It is drawing showing the packet structure in an Isochronous transfer.
- [Drawing 22] It is drawing showing an example of the communication link cycle of an IEEE1394 serial bus.
- [Drawing 23] It is a flow chart for explaining from bus reset to setting out of ID.
- [Drawing 24] It is a flow chart explaining the decision approach of the root.
- [Drawing 25] It is a flow chart explaining the procedure from parentage decision to setting out of all the nodes ID.
- [Drawing 26] It is the flow chart which shows the process of an Arbitration.

### **[Description of Notations]**

21 Lens

22 CCD Component

23 A/D-Conversion Section  
24 Image-Processing Section  
25 Image Transformation Section  
26 Data-Logging Section  
27, 31, 81 Interface section  
32 82 JPEG thawing section  
33 84 Print image-processing section  
34 85 Record position control processing section  
35 86 Head actuation signal transformation section  
36 Buffer Memory  
37 88 Printer engine  
83 Buffer Memory 1  
87 Buffer Memory 2

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[Translation done.]

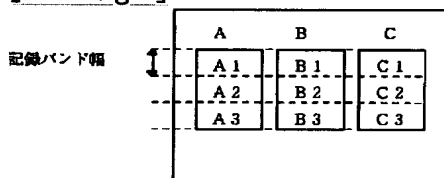
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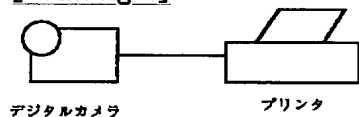
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- 3.In the drawings, any words are not translated.

## DRAWINGS

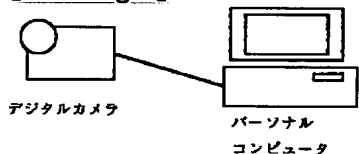
[Drawing 1]



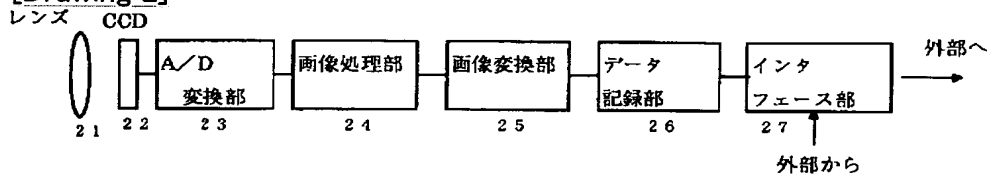
[Drawing 4]



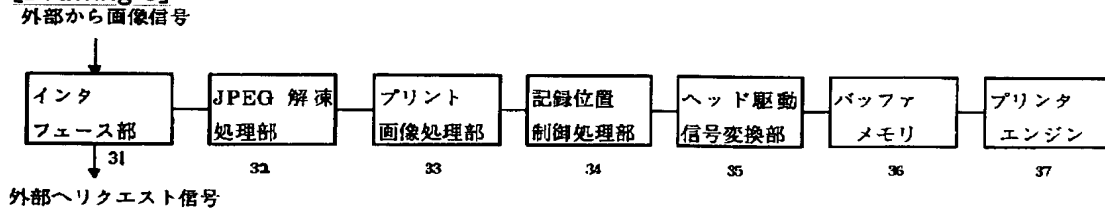
[Drawing 5]



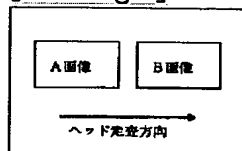
[Drawing 2]



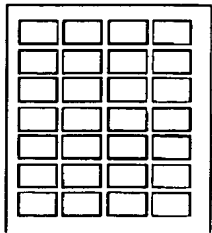
[Drawing 3]



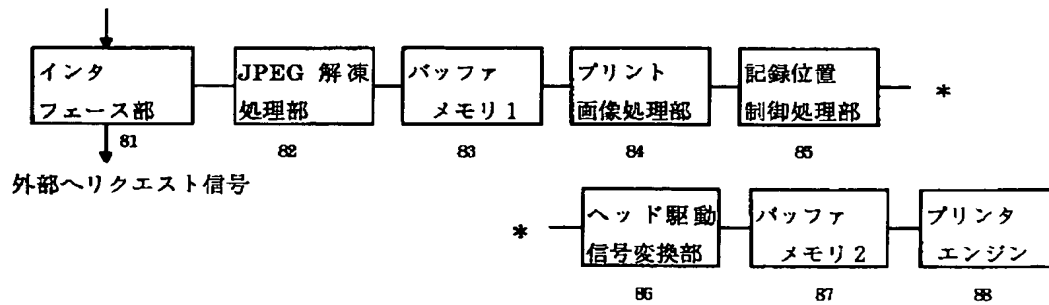
[Drawing 6]



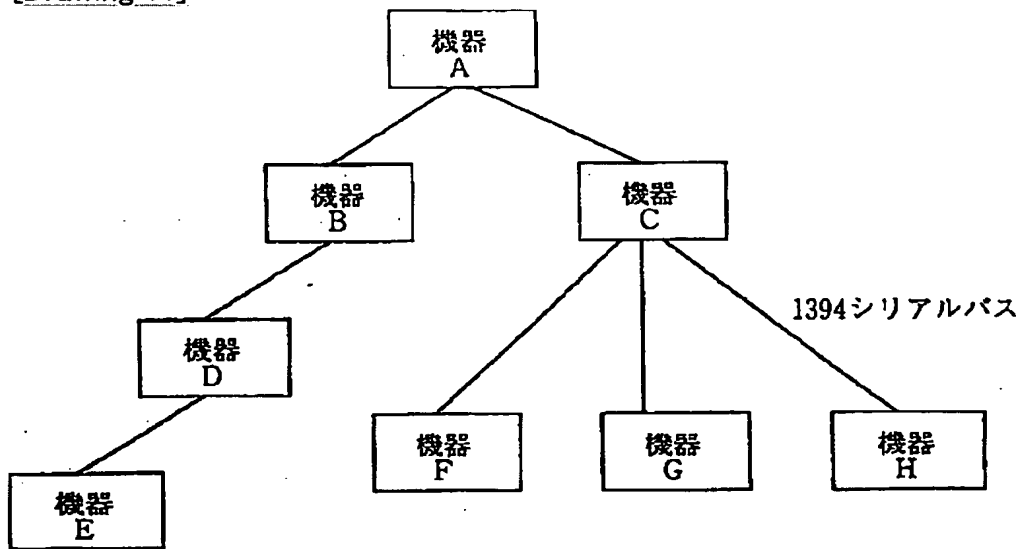
[Drawing 7]



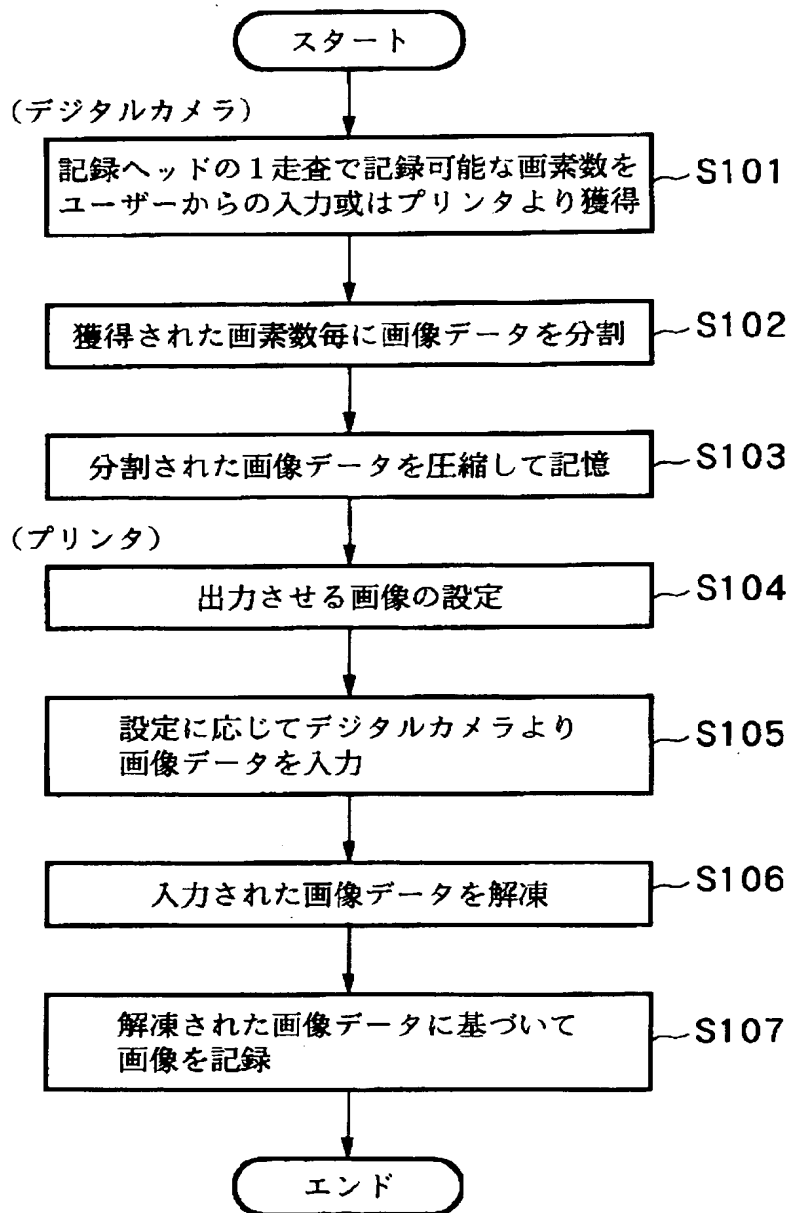
[Drawing 8]  
外部から画像信号



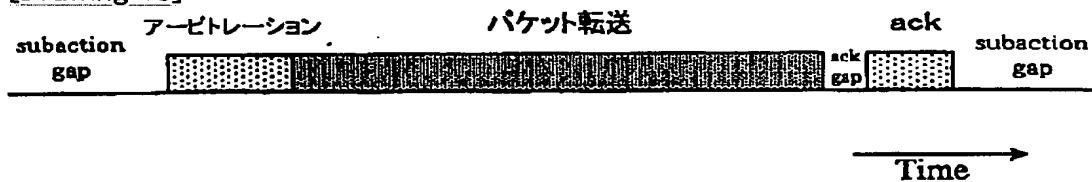
[Drawing 11]



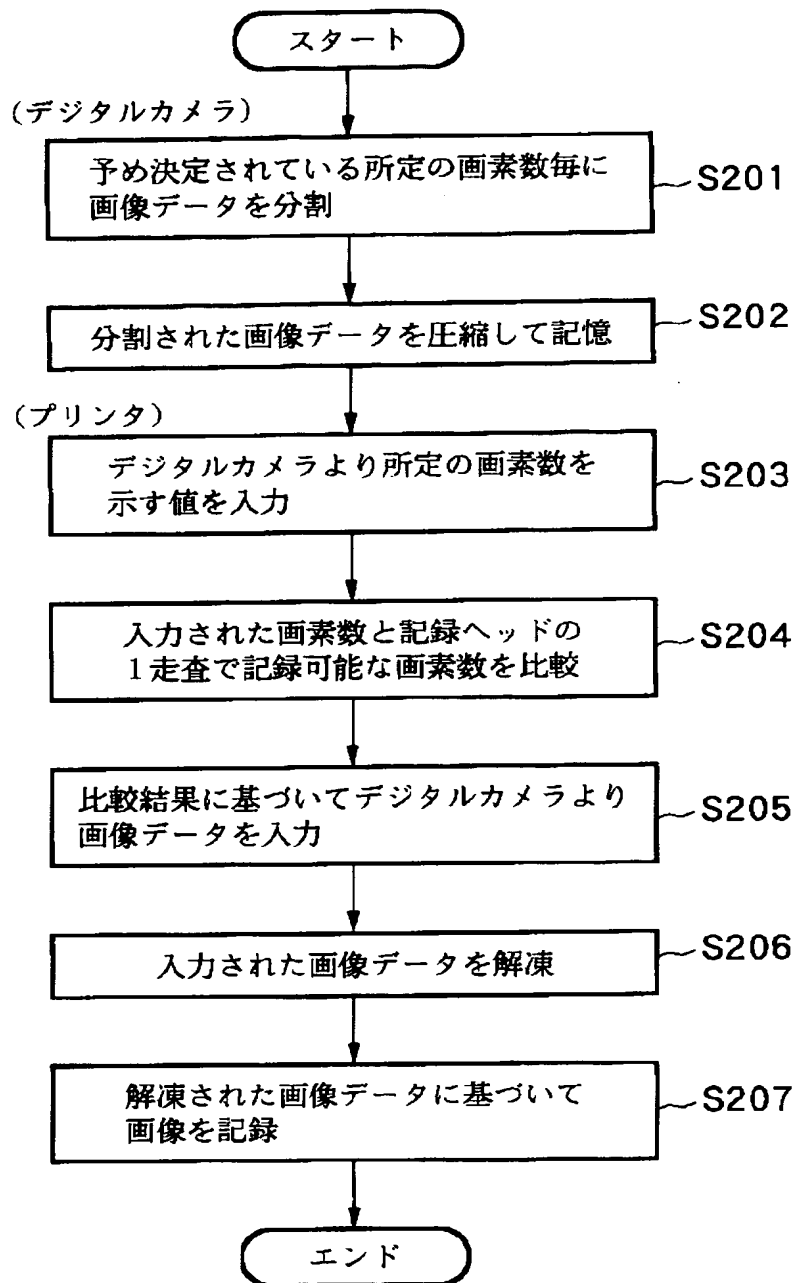
[Drawing 9]



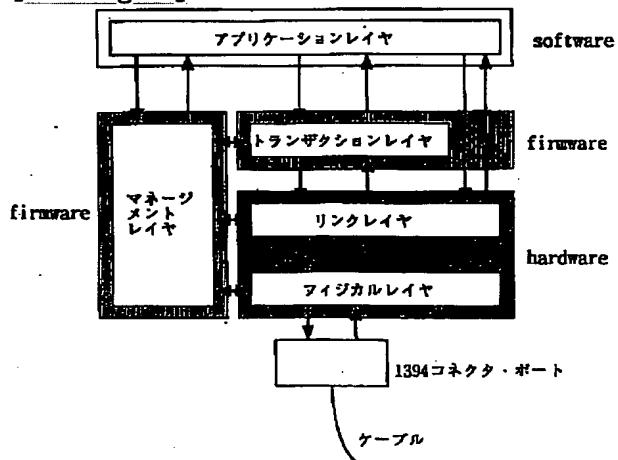
[Drawing 18]



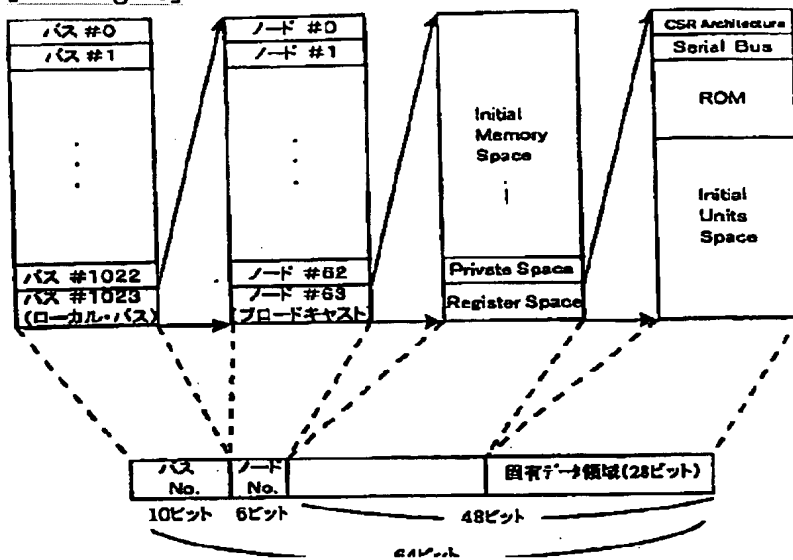
[Drawing 10]



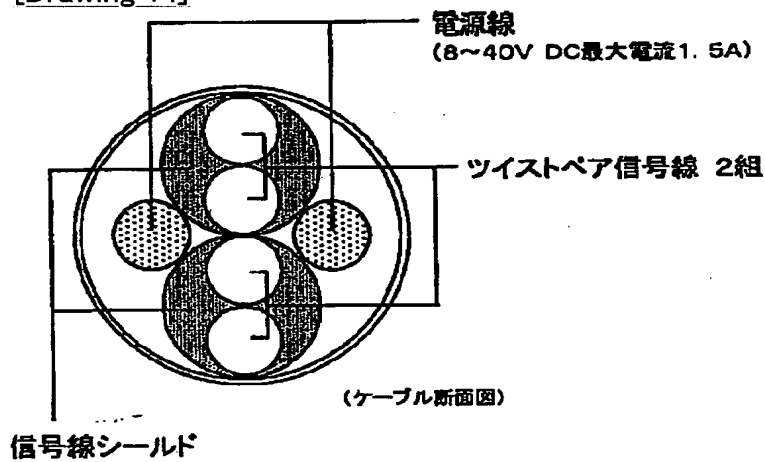
[Drawing 12]



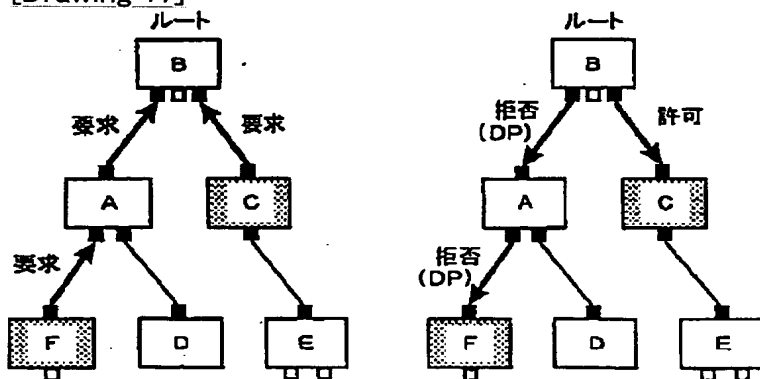
**[Drawing 13]**



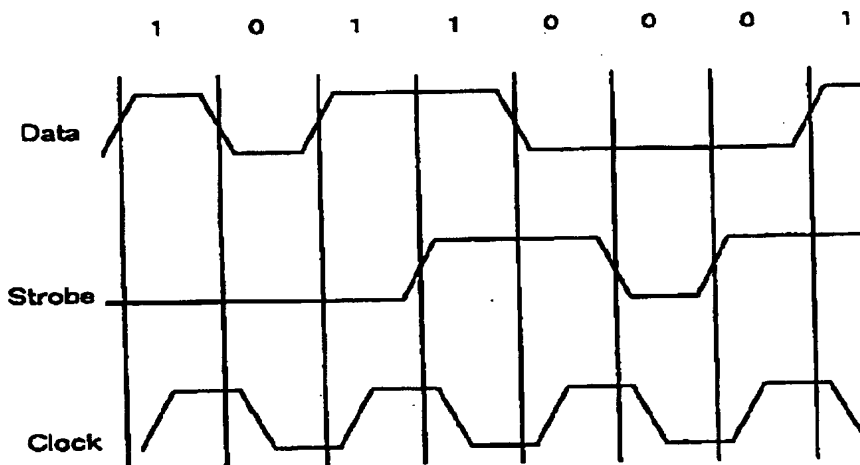
**[Drawing 14]**



**[Drawing 17]**

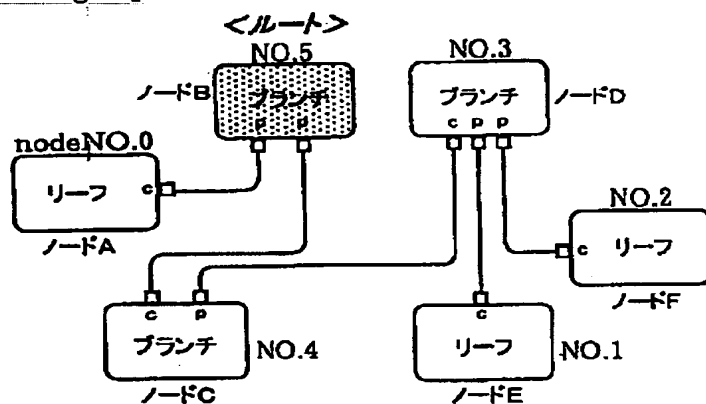


**[Drawing 15]**



(DataとStrobeの排他的論理和信号)

[Drawing 16]



□ : ポート

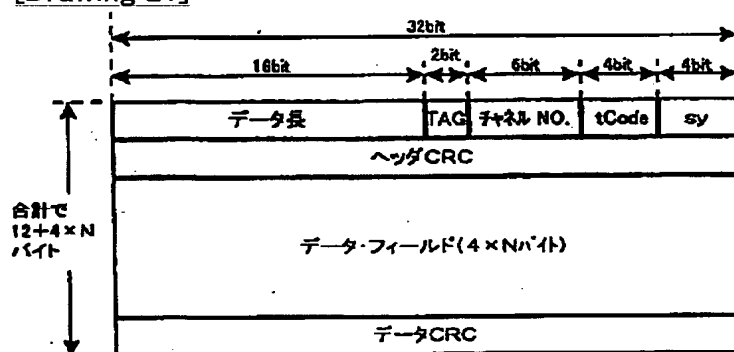
ブランチ: 2つ以上のノード接続があるノード

リーフ: 1つのポートのみ接続があるノード

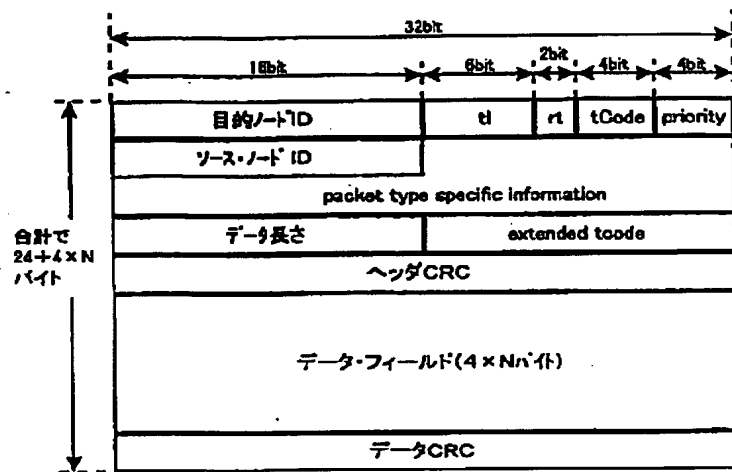
c: 子のノードに相当するポート

p: 親のノードに相当するポート

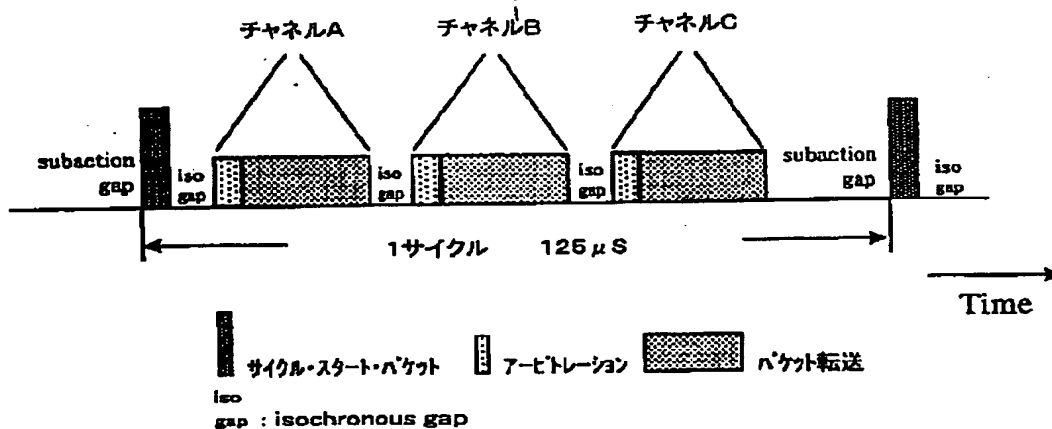
[Drawing 21]



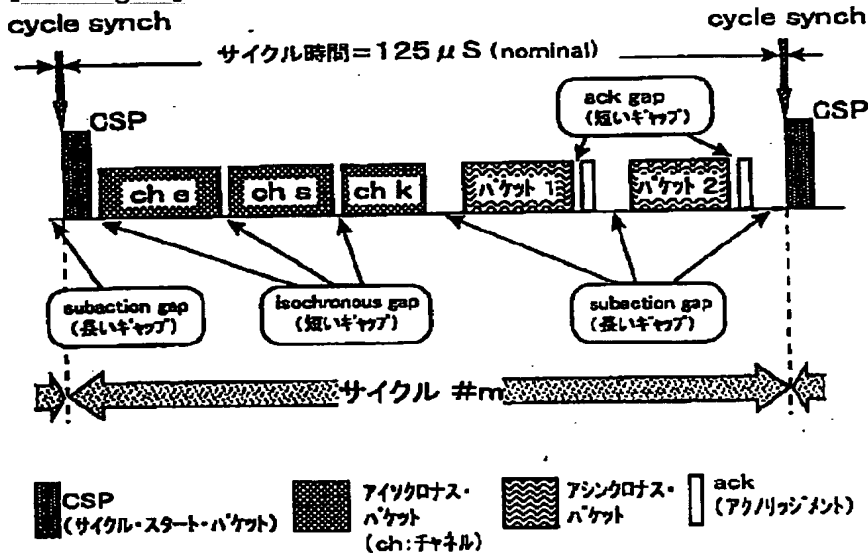
[Drawing 19]



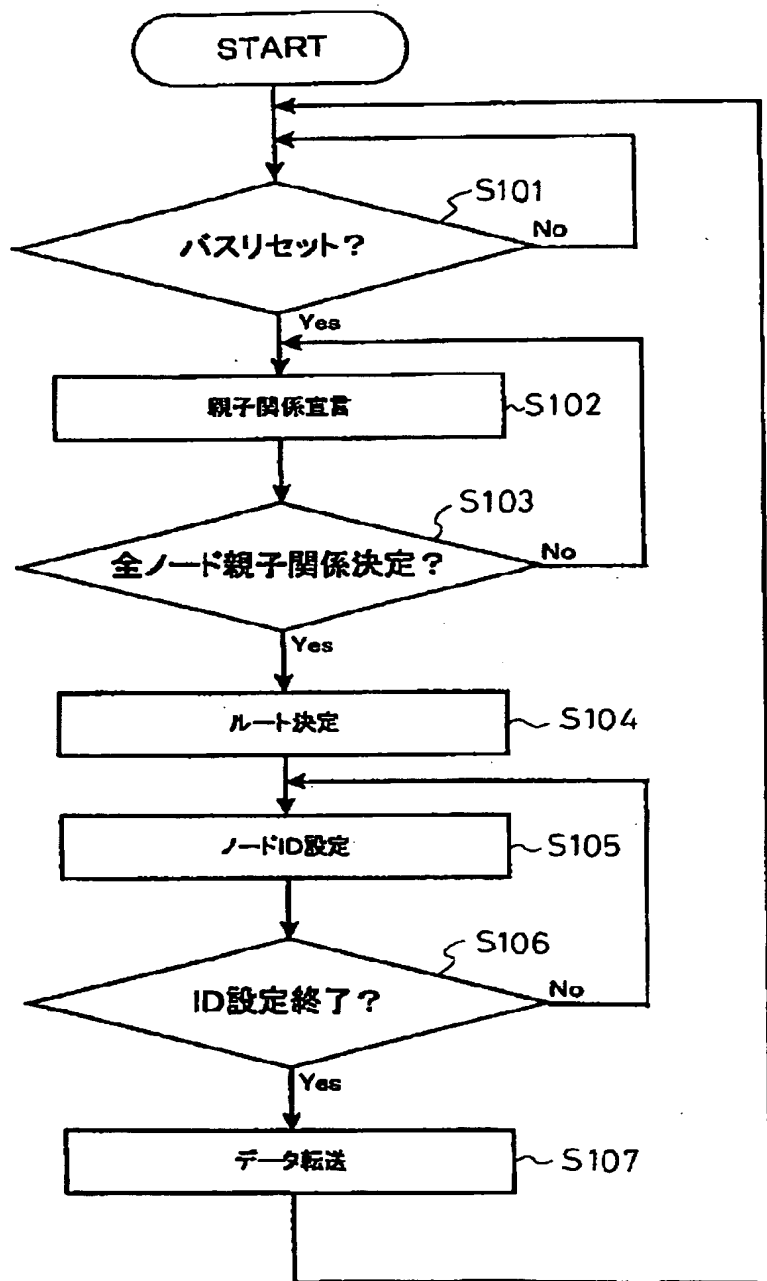
[Drawing 20]



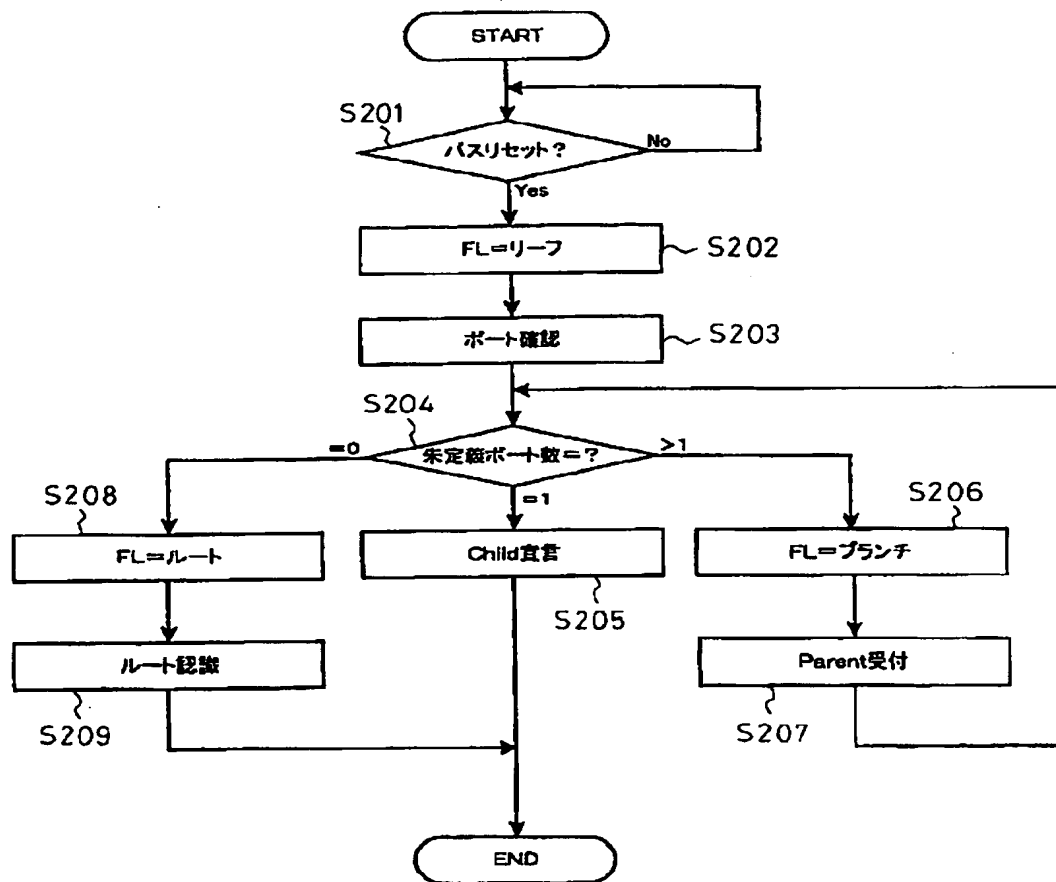
[Drawing 22]



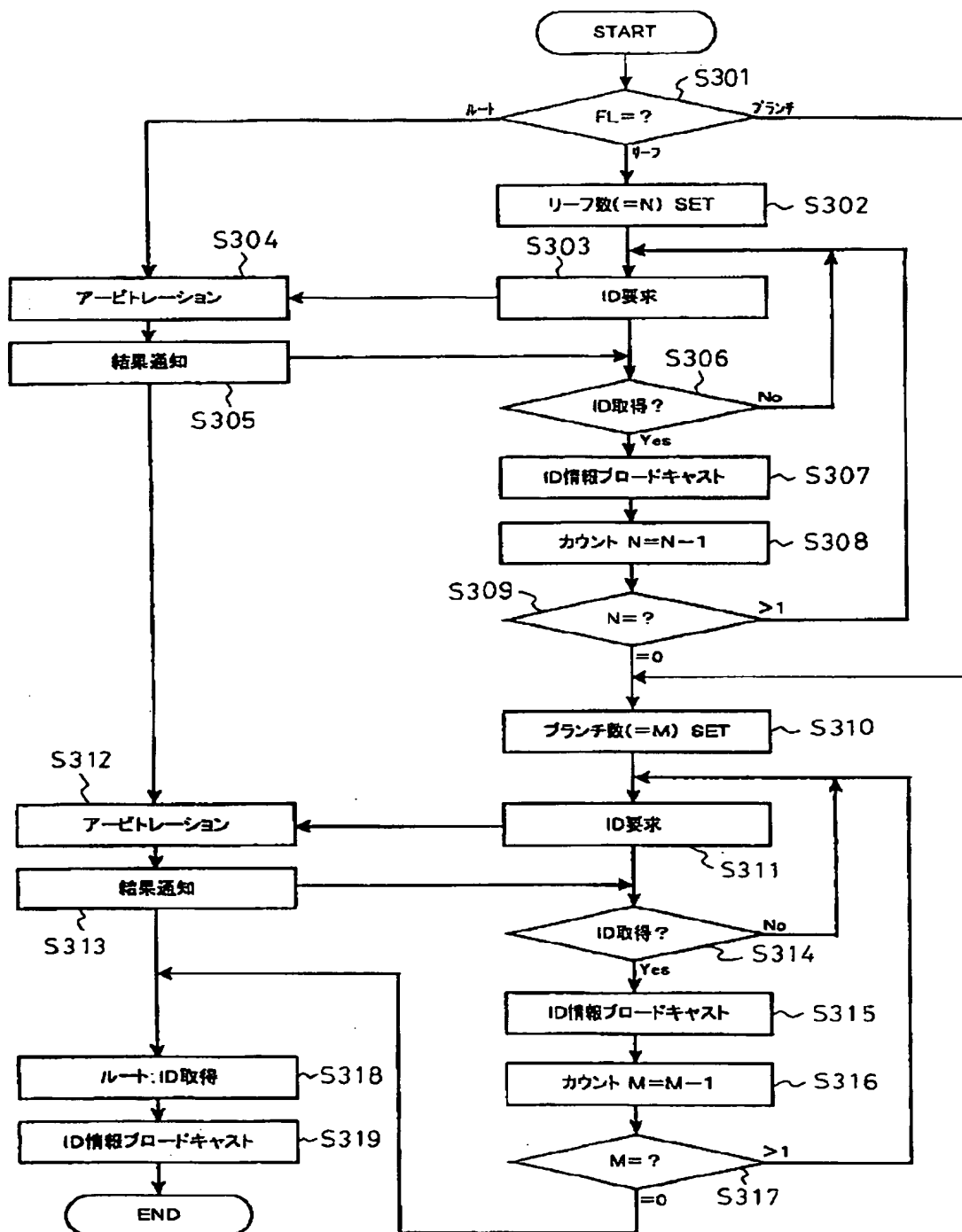
[Drawing 23]



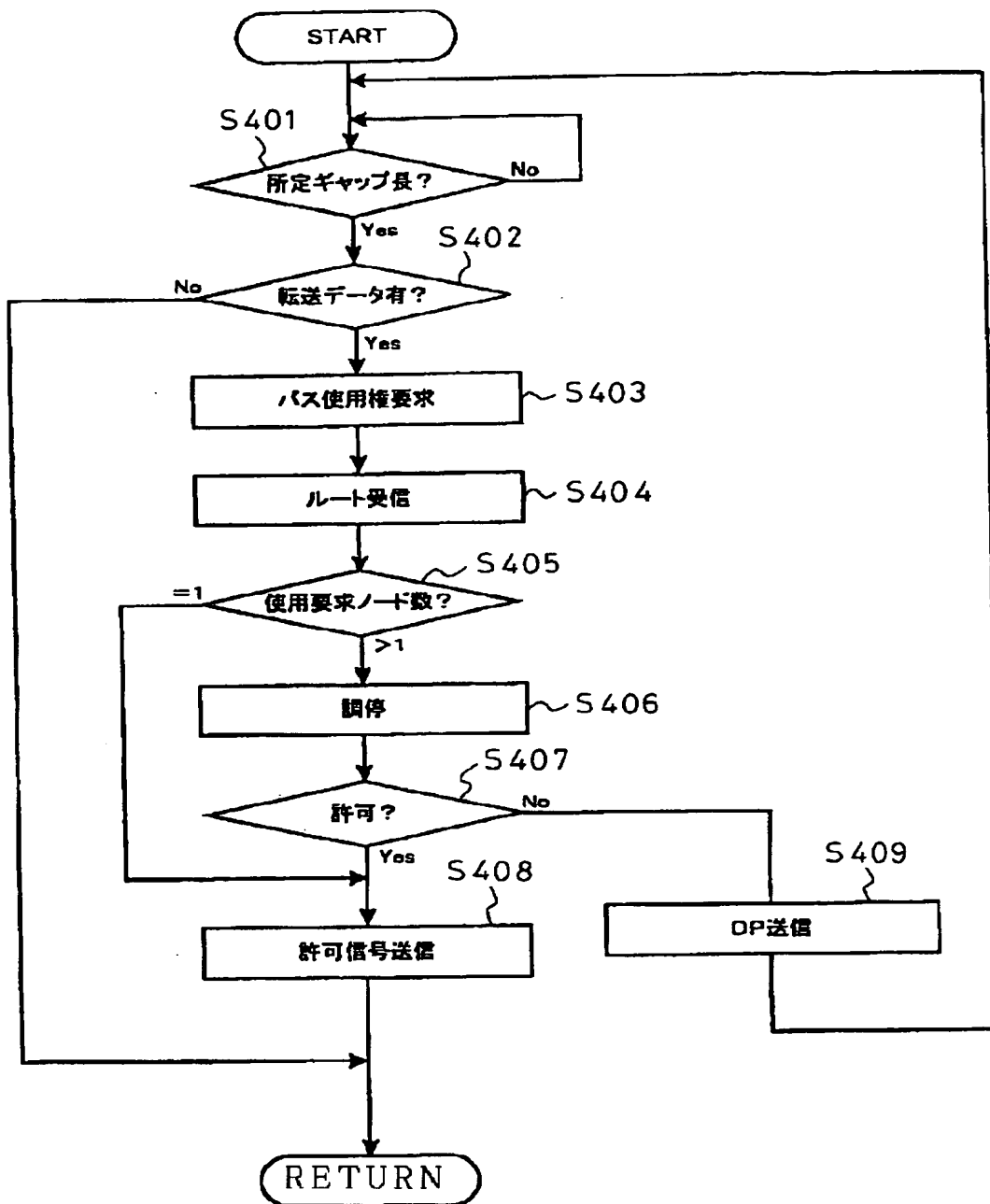
[Drawing 24]



[Drawing 25]



[Drawing 26]



[Translation done.]

**\* NOTICES \***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**CORRECTION OR AMENDMENT**

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[Procedure amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[The content of amendment]

[Claim(s)]

[Claim 1]

It is the image processing system which processes to the inputted image data and is outputted to an output unit,

Means of communications which communicates to mutual [ said / output unit and mutual ],

A receiving means to receive the output unit information which shows the output unit of the image data of said output unit from this output unit through said means of communications,

A compression means to divide and compress said inputted image data based on the output unit information received with said receiving means

The image processing system characterized by preparation \*\*\*\*\*.

[Claim 2]

It is the control approach of the image processing system which processes to the inputted image data and is outputted to an output unit,

The receiving process which receives the output unit information which shows the output unit of the image data of said output unit from this output unit,

The pressing operation which divides and compresses said inputted image data based on the

output unit information received at said receiving process

The control approach of the image processing system characterized by preparation \*\*\*\*\*.

[Claim 3]

Said pressing operation is equipped with the storage process which memorizes the compressed image data to a storage.

The control approach of the image processing system according to claim 2 characterized by things.

[Claim 4]

The image data memorized by said storage according to output setting out of said output unit and said output unit is transmitted to this output unit.

The control approach of the image processing system according to claim 2 characterized by things.

[Claim 5]

Said output setting out includes setting out about amplification/reduction percentage of the image outputted at least, and image size.

The control approach of the image processing system according to claim 4 characterized by things.

[Claim 6]

Said inputted image data is divided per predetermined, and said pressing operation compresses it.

The control approach of the image processing system according to claim 2 characterized by things.

[Claim 7]

Said predetermined unit is the number of pixels of the multiple of 8.

The control approach of the image processing system according to claim 6 characterized by things.

[Claim 8]

Said pressing operation divides and compresses the this inputted image data for every number of pixels of said multiple of 8 to either [ at least ] the pixel direction of said inputted image data, or the direction of a line.

The control approach of the image processing system according to claim 7 characterized by things.

[Claim 9]

It is the image processing system which has the image processing system which processes to the inputted image data, and the output unit which outputs the image based on the image data processed with this image processing system,

Means of communications which communicates mutually with said image processing system and said output unit,

A 1st transfer means to transmit the output unit information which shows the output unit of the image data of said output unit to said image processing system through said means of communications,

A compression means to divide and compress said inputted image data based on the output unit information notified with said advice means,

A 2nd transfer means to transmit the image data compressed with said compression means according to output setting out of said output unit and said output unit to this output unit through said means of communications

The image processing system by which it is preparation \*\*\*\*\* characterized.

[Claim 10]

Said output setting out is \*\* about setting out about amplification/reduction percentage of the image outputted at least, and image size. Image processing system according to claim 9 characterized by \*\*\*\*\*.

[Claim 11]

Said compression means is equipped with a storage means to memorize the compressed image data.

The image processing system according to claim 9 characterized by things.

[Claim 12]

Said inputted image data is divided per predetermined, and said compression means compresses it.

The image processing system according to claim 9 characterized by things.

[Claim 13]

Said means of communications is an IEEE1394 serial bus.

The image processing system according to claim 9 characterized by things.

[Claim 14]

It is the output unit which outputs the image based on the image data inputted from the image processing system,

Means of communications which communicates to mutual [ said / image processing system and mutual ],

A transmitting means to transmit the output unit information which shows the output unit of the image data of the output unit concerned to said image processing system through said means of communications,

A receiving means to receive said output unit and the image data according to output setting out of the output unit concerned from said image processing system through said means of communications

The output unit characterized by preparation \*\*\*\*\*.

[Claim 15]

Said output setting out includes setting out about amplification/reduction percentage of the image outputted at least, and image size.

The output unit according to claim 14 characterized by things.

[Claim 16]

The image data inputted from said image processing system is further equipped with a thawing means to be the compressed image data and to thaw said compressed image data.

The output unit according to claim 14 characterized by things.

[Claim 17]

The image data inputted from said image processing system is image data compressed per predetermined,

Said receiving means receives the information which shows said predetermined unit from said image processing system, and is equipped with a comparison means to compare with said output unit information the information which shows this predetermined unit,

Based on the comparison result of said comparison means, the number of image data compressed in said predetermined unit corresponding to said output unit is determined.

The output unit according to claim 14 characterized by things.

[Claim 18]

Said means of communications is an IEEE1394 serial bus.

The output unit according to claim 14 characterized by things.

[Claim 19]

The program code of control of the image processing system which processes to the inputted image data and is outputted to an output unit is stored, and an approach is the storage [ computer ] which can be read,

The program code of the receiving process which receives the output unit information which shows the output unit of the image data of said output unit from this output unit,

The program code of the pressing operation which divides and compresses said inputted image data based on the output unit information received at said receiving process

The storage characterized by preparation \*\*\*\*\*.

[Translation done.]

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(71)出願人 000001007

キヤノン株式会社

東京都大田区下丸子3丁目30番2号

(72)発明者 高橋 賢司

東京都大田区下丸子3丁目30番2号 キヤ

ノン株式会社内

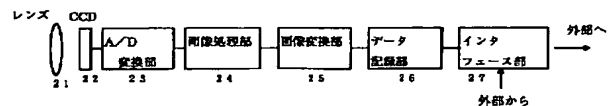
(74)代理人 弁理士 大塚 康徳 (外1名)

(54)【発明の名称】 画像処理装置及びその制御方法、画像処理システム、出力装置、記憶媒体

(57)【要約】

【課題】 コストを上げることなく、トータルスループットを向上することができる画像処理装置及びその制御方法、画像処理システム、出力装置を提供する。

【解決手段】 デジタルカメラとプリンタが接続されて構成される画像処理システムにおいて、デジタルカメラ側のインタフェース部27によってプリンタと相互に通信し、そのインタフェース部27を介してプリンタの記録ヘッドの1走査で記録可能な画素数を受信する。受信した画素数に基づいて、デジタルカメラに入力された画像データを画像変換部25によって分割し圧縮する。



## 【特許請求の範囲】

【請求項 1】 入力された画像データに処理を施し出力装置に出力する画像処理装置であって、前記出力装置と相互に通信する通信手段と、前記通信手段を介して、前記出力装置の画像データの出力単位を示す出力単位情報を該出力装置より受信する受信手段と、

前記受信手段で受信した出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮手段とを備えることを特徴とする画像処理装置。

【請求項 2】 前記圧縮手段は、圧縮した画像データを記憶する記憶手段を備えることを特徴とする請求項 1 に記載の画像処理装置。

【請求項 3】 前記出力単位及び前記出力装置の出力設定に応じて前記記憶手段に記憶された画像データを、前記通信手段を介して該出力装置へ送信することを特徴とする請求項 1 に記載の画像処理装置。

【請求項 4】 前記出力設定は、少なくとも出力する画像の拡大／縮小率、画像サイズに関する設定を含むことを特徴とする請求項 3 に記載の画像処理装置。

【請求項 5】 前記圧縮手段は、前記入力された画像データを所定単位で分割し圧縮することを特徴とする請求項 1 に記載の画像処理装置。

【請求項 6】 前記所定単位は、8 の倍数の画素数であることを特徴とする請求項 5 に記載の画像処理装置。

【請求項 7】 前記圧縮手段は、前記入力された画像データのピクセル方向あるいはライン方向の少なくとも一方に対し、該入力された画像データを前記 8 の倍数の画素数毎に分割し圧縮することを特徴とする請求項 6 に記載の画像処理装置。

【請求項 8】 前記通信手段は、IEEE1394 シリアルバスであることを特徴とする請求項 1 に記載の画像処理装置。

【請求項 9】 入力された画像データに処理を施し出力装置に出力する画像処理装置の制御方法であって、前記出力装置の画像データの出力単位を示す出力単位情報を該出力装置より受信する受信工程と、前記受信工程で受信した出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮工程とを備えることを特徴とする画像処理装置の制御方法。

【請求項 10】 前記圧縮工程は、圧縮した画像データを記憶媒体に記憶する記憶工程を備えることを特徴とする請求項 9 に記載の画像処理装置の制御方法。

【請求項 11】 前記出力単位及び前記出力装置の出力設定に応じて前記記憶媒体に記憶された画像データを該出力装置へ送信することを特徴とする請求項 9 に記載の画像処理装置の制御方法。

【請求項 12】 前記出力設定は、少なくとも出力する画像の拡大／縮小率、画像サイズに関する設定を含むことを特徴とする請求項 11 に記載の画像処理装置の制御

方法。

【請求項 13】 前記圧縮工程は、前記入力された画像データを所定単位で分割し圧縮することを特徴とする請求項 9 に記載の画像処理装置の制御方法。

【請求項 14】 前記所定単位は、8 の倍数の画素数であることを特徴とする請求項 13 に記載の画像処理装置の制御方法。

【請求項 15】 前記圧縮工程は、前記入力された画像データのピクセル方向あるいはライン方向の少なくとも一方に対し、該入力された画像データを前記 8 の倍数の画素数毎に分割し圧縮することを特徴とする請求項 14 に記載の画像処理装置の制御方法。

【請求項 16】 入力された画像データに処理を施す画像処理装置と、該画像処理装置で処理された画像データに基づく画像を出力する出力装置を有する画像処理システムであって、

前記画像処理装置と前記出力装置とで相互に通信する通信手段と、

前記通信手段を介して、前記出力装置の画像データの出力単位を示す出力単位情報を前記画像処理装置へ転送する第 1 転送手段と、

前記通知手段で通知された出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮手段と、前記通信手段を介して、前記出力単位及び前記出力装置の出力設定に応じて前記圧縮手段で圧縮された画像データを該出力装置へ転送する第 2 転送手段とを備えることを特徴とする画像処理システム。

【請求項 17】 前記出力設定は、少なくとも出力する画像の拡大／縮小率、画像サイズに関する設定を含むことを特徴とする請求項 16 に記載の画像処理システム。

【請求項 18】 前記圧縮手段は、圧縮した画像データを記憶する記憶手段を備えることを特徴とする請求項 16 に記載の画像処理システム。

【請求項 19】 前記圧縮手段は、前記入力された画像データを所定単位で分割し圧縮することを特徴とする請求項 16 に記載の画像処理システム。

【請求項 20】 前記通信手段は、IEEE1394 シリアルバスであることを特徴とする請求項 16 に記載の画像処理システム。

【請求項 21】 画像処理装置より入力された画像データに基づく画像を出力する出力装置であって、前記画像処理装置と相互に通信する通信手段と、前記通信手段を介して、前記画像処理装置へ当該出力装置の画像データの出力単位を示す出力単位情報を送信する送信手段と、

前記通信手段を介して、前記出力単位及び当該出力装置の出力設定に応じた画像データを前記画像処理装置より受信する受信手段とを備えることを特徴とする出力装置。

【請求項 22】 前記出力設定は、少なくとも出力する

画像の拡大／縮小率、画像サイズに関する設定を含むことを特徴とする請求項21に記載の出力装置。

【請求項23】 前記画像処理装置より入力された画像データは、圧縮された画像データであり、前記圧縮された画像データを解凍する解凍手段を更に備えることを特徴とする請求項21に記載の出力装置。

【請求項24】 前記画像処理装置より入力される画像データは、所定単位で圧縮された画像データであり、前記受信手段は、前記所定単位を示す情報を前記画像処理装置より受信し、該所定単位を示す情報と前記出力単位情報とを比較する比較手段を備え、前記比較手段の比較結果に基づいて、前記出力単位に対応する前記所定単位で圧縮された画像データ数を決定することを特徴とする請求項21に記載の出力装置。

【請求項25】 前記通信手段は、IEEE1394シリアルバスであることを特徴とする請求項21に記載の出力装置。

【請求項26】 入力された画像データに処理を施し出力装置に出力する画像処理装置の制御のプログラムコードが格納され方法がコンピュータより読み出し可能な記憶媒体であって、前記出力装置の画像データの出力単位を示す出力単位情報を該出力装置より受信する受信工程のプログラムコードと、前記受信工程で受信した出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮工程のプログラムコードとを備えることを特徴とする記憶媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、入力された画像データに処理を施し出力装置に出力する画像処理装置及びその制御方法、画像処理システム、出力装置、記憶媒体に関するものである。

【0002】

【従来の技術】 従来、デジタルカメラで撮影された画像データは、パーソナルへと送信され、画像データの出力はパーソナルコンピュータと接続されているプリンタにより行われていた。しかしながら、パソコンユーザーでないユーザーにもデジタルカメラの使用を可能とするために、デジタルカメラとプリンタを直接接続可能とし、画像データに基づく画像を記録することができる画像処理システムが開発されている。

【0003】 一般的に、デジタルカメラには撮影した画像に基づく画像データを記憶するための記憶媒体の記憶容量に制限がある。そのため、その記憶媒体にできるだけ多くの画像データを記憶できるようにするため、画像データをJPEG圧縮して記憶媒体に記憶する。このようなJPEG圧縮された画像データを、デジタルカメラと直接接続されたプリンタによる記録（ダイレクトプリント）を行うためには、デジタルカメラあるいはプリン

タにJPEG圧縮された画像データをJPEG解凍して得られる画像データ量分の記憶容量を持つ記憶媒体を必要とする。現在、このダイレクトプリントを実現している画像処理システムのプリンタは、A6サイズのため、1枚の記録媒体に記録を行う記録動作でA6サイズの画像データ複数分を記録することはない。そのため、A6サイズの画像データ分の記憶容量を持つ記憶媒体（バッファメモリ）があれば実現可能である。しかし、例えば、図1のように、A4サイズの記録媒体上にプリンタの記録ヘッドの走査方向にA、B、Cの3つの画像を記録する場合は、記録ヘッドの1走査で記録可能な画素数が限定されているため、1回目の記録ヘッドの走査では、バッファメモリに図1中のA1、B1、C1の部分に対応する画像データを記憶、2回目の記録ヘッドの走査では図1中のA2、B2、C2の部分といったように、各記録媒体の記録領域に対応する画像データを順次バッファメモリに記憶していけば良い。

【0004】

【発明が解決しようとする課題】 しかしながら、上記従来の画像処理システムにおいて、上記のような記録を実現するためには、デジタルカメラあるいはプリンタにJPEG圧縮されたA4サイズのA、B、Cの画像データをJPEG解凍した画像データ3つ分のバッファメモリを持つことで可能となるが、これはコスト等の問題から実現は困難である。

【0005】 また、デジタルカメラあるいはプリンタにJPEG圧縮されたA4サイズの画像データをJPEG解凍した画像データ1つ分のバッファメモリを持ち、Aの画像データをJPEG解凍、Aの画像データの内A1部分の画像データのバッファメモリへの書き込み、Bの画像データをJPEG解凍、Bの画像データの内B1部分の画像データのバッファメモリへの書き込み、Cの画像データのJPEG解凍、Cの画像データの内C1部分の画像データのバッファメモリへの書き込み、1回目の記録ヘッドの走査、Aの画像データをJPEG解凍、Aの画像データの内A2部分の画像データのバッファメモリへの書き込み、Bの画像データをJPEG解凍、Bの画像データの内B2部分の画像データのバッファメモリへの書き込み、Cの画像データのJPEG解凍、Cの画像データの内C2部分の画像データのバッファメモリへの書き込み、2回目の記録ヘッドの走査というような記録を行うことで、バッファメモリを節約することもできるが、JPEG圧縮された画像データのJPEG解凍する回数が増えるため、記録速度が低下するという問題が発生する。

【0006】 本発明は上記の問題点に鑑みてなされたものであり、コストを上げることなく、トータルスループットを向上することができる画像処理装置及びその制御方法、画像処理システム、出力装置、媒体を提供することを目的とする。

## 【0007】

【課題を解決するための手段】上記の目的を解決するための本発明による画像処理装置は以下の構成を備える。即ち、入力された画像データに処理を施し出力装置に出力する画像処理装置であって、前記出力装置と相互に通信する通信手段と、前記通信手段を介して、前記出力装置の画像データの出力単位を示す出力単位情報を該出力装置より受信する受信手段と、前記受信手段で受信した出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮手段とを備える。

【0008】また、好ましくは、前記圧縮手段は、圧縮した画像データを記憶する記憶手段を備える。また、好ましくは、前記出力単位及び前記出力装置の出力設定に応じて前記記憶手段に記憶された画像データを、前記通信手段を介して該出力装置へ送信するまた、好ましくは、前記出力設定は、少なくとも出力する画像の拡大／縮小率、画像サイズに関する設定を含む。

【0009】また、好ましくは、前記圧縮手段は、前記入力された画像データを所定単位で分割し圧縮する。また、好ましくは、前記所定単位は、8の倍数の画素数である。前記圧縮手段は、前記入力された画像データのピクセル方向あるいはライン方向の少なくとも一方に対し、該入力された画像データを前記8の倍数の画素数毎に分割し圧縮する。

【0010】また、好ましくは、前記通信手段は、IEEE1394シリアルバスである。上記の目的を達成するための本発明による画像処理装置の制御方法は以下の構成を備える、即ち、入力された画像データに処理を施し出力装置に出力する画像処理装置の制御方法であって、前記出力装置の画像データの出力単位を示す出力単位情報を該出力装置より受信する受信工程と、前記受信工程で受信した出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮工程とを備える。

【0011】上記の目的を達成するための本発明による画像処理システムは以下の構成を備える。即ち、入力された画像データに処理を施す画像処理装置と、該画像処理装置で処理された画像データに基づく画像を出力する出力装置を有する画像処理システムであって、前記画像処理装置と前記出力装置とで相互に通信する通信手段と、前記通信手段を介して、前記出力装置の画像データの出力単位を示す出力単位情報を前記画像処理装置へ転送する第1転送手段と、前記通知手段で通知された出力単位情報に基づいて、前記入力された画像データを分割し圧縮する圧縮手段と、前記通信手段を介して、前記出力単位及び前記出力装置の出力設定に応じて前記圧縮手段で圧縮された画像データを該出力装置へ転送する第2転送手段とを備える。

【0012】上記の目的を達成するための本発明による出力装置は以下の構成を備える。即ち、画像処理装置より入力された画像データに基づく画像を出力する出力装

置であって、前記画像処理装置と相互に通信する通信手段と、前記通信手段を介して、前記画像処理装置へ当該出力装置の画像データの出力単位を示す出力単位情報を送信する送信手段と、前記通信手段を介して、前記出力単位及び当該出力装置の出力設定に応じた画像データを前記画像処理装置より受信する受信手段とを備える。

## 【0013】

【発明の実施の形態】以下の実施形態では、デジタルカメラとプリンタとの接続にデジタルインターフェース(D-I/F)を用いた例を説明するが、これに先立ち、本実施形態で採用可能なD-I/Fの代表技術として、IEEE1394を説明する。

《IEEE1394の技術の概要》民生用デジタルVCRやDVDプレーヤの登場に伴って、ビデオデータやオーディオデータなどを通信するために、リアルタイムで、かつ高情報量のデータ転送のサポートが必要になっている。こういったビデオデータやオーディオデータをリアルタイムで転送し、パソコン(PC)に取り込んだり、またはその他のデジタル機器に転送を行なうには、必要な転送機能を備えた高速データ転送可能なインタフェースが必要になってくる。そういった観点から開発されたインタフェースが、IEEE1394-1995 (HighPerformance Serial Bus、以下1394シリアルバスという)である。

【0014】図11は、1394シリアルバスを用いて構成されるネットワーク・システムの構成例を示す図である。このシステムは機器A、B、C、D、E、F、G、Hを備えており、A-B間、A-C間、B-D間、D-E間、C-F間、C-G間、及びC-H間はそれぞれ1394シリアルバスのツイスト・ペア・ケーブルで接続されている。これらの機器A～Hは、例えばパソコン、デジタルVTR、DVD、デジタルカメラ、ハードディスク、モニタ、チューナー等である。

【0015】各機器間の接続方式は、ディジーチェーン方式とノード分岐方式とを混在可能としたものであり、自由度の高い接続が可能である。また、各機器は各自固有のIDを有し、それぞれが認識し合うことによって1394シリアルバスで接続された範囲において、1つのネットワークを構成している。各デジタル機器間をそれぞれ1本の1394シリアルバスケーブルで順次接続するだけで、それぞれの機器が中継の役割を行い、全体として1つのネットワークを構成するものである。また、1394シリアルバスはPlug&Play機能を有し、ケーブルを機器に接続した時点で自動的に機器の認識や接続状況などを認識する機能を有している。

【0016】また、図11に示したようなシステムにおいて、ネットワークからある機器が削除されたり、または新たに追加されたときなどには、自動的にバスリセットを行い、それまでのネットワーク構成をリセットしてから、新たなネットワークの再構築を行なう。この機能

によって、その時々ネットワークの構成を常時設定、認識することができる。

【0017】またデータ転送速度は、100/200/400Mbpsを備えており、上位の転送速度を持つ機器が下位の転送速度をサポートし、互換をとるようになっている。データ転送モードとしては、コントロール信号などの非同期データ（Asynchronousデータ：以下Asyncデータという）を転送するAsynchronous転送モードとリアルタイムなビデオデータやオーディオデータ等の同期データ（Isochronousデータ：以下Isoデータという）を転送するIsochronous転送モードがある。このAsyncデータとIsoデータは、各サイクル（通常1サイクル125μs）の中において、サイクル開始を示すサイクル・スタート・パケット（CSP）を転送した後、Isoデータの転送をAsyncデータより優先しつつサイクル内で混在して転送される。

【0018】図12は1394シリアルバスの構成要素を示す図である。1394シリアルバスは全体としてレイヤ（階層）構造で構成されている。図12に示したように、1394シリアルバスのケーブルとコネクタが接続されるコネクタポートがあり、その上にハードウェアとしてフィジカル・レイヤとリンク・レイヤを位置づけている。

【0019】ハードウェア部は実質的なインターフェイスチップの部分であり、そのうちフィジカル・レイヤは符号化やコネクタ関連の制御等を行い、リンク・レイヤはパケット転送やサイクルタイムの制御等を行なう。ファームウェア部のトランザクション・レイヤは、転送（トランザクション）すべきデータの管理を行ない、Read、Write、Lockの命令を出す。シリアルバスマネージメント（マネージメント・レイヤ）は、接続されている各機器の接続状況やIDの管理を行ない、ネットワークの構成を管理する部分である。以上のハードウェア及びファームウェアまでが実質上の1394シリアルバスの構成である。

【0020】またソフトウェア部のアプリケーション・レイヤは、使用するアプリケーションソフトによって異なり、インタフェース上にのせるデータを規定する部分であり、プリンタプロトコルやAVCプロトコルなどが規定されている。以上が1394シリアルバスの構成である。図13は、1394シリアルバスにおけるアドレス空間を示す図である。1394シリアルバスに接続された各機器（ノード）には必ず各ノード固有の64ビットアドレスを持たせておく。そしてこのアドレスをROMに格納しておくことで、自分や相手のノードアドレスを常時認識できるとともに、相手を指定した通信も行なえる。1394シリアルバスのアドレッシングは、IEEE1212規格に準じた方式であり、アドレス設定は、最初の10ビットがバスの番号の指定用に、次の6ビットがノードID番号の指定用に使われる。そして、

残りの48ビットが機器に与えられたアドレス幅になり、それぞれ固有のアドレス空間として使用できる。なお、48ビット中の後半の28ビットは固有データの領域として、各機器の識別や使用条件の指定の情報などを格納する。

【0021】以上が1394シリアルバスの技術の概要である。次に、1394シリアルバスの特徴といえる技術の部分を、より詳細に説明することにする。

《1394シリアルバスの電氣的仕様》図14は1394シリアルバス・ケーブルの断面図である。1394シリアルバスでは接続ケーブル内に6ピン、即ち2組のツイストペア信号線の他に、電源ラインを設けている。これによって、電源を持たない機器や、故障により電圧低下した機器等にも電力の供給が可能になっている。なお、電源線内を流れる電源の電圧は8~40V、電流は最大電流DC1.5Aと規定されている。なお、DVケーブルと呼ばれる規格では電源を省いた4ピンで構成されている。

【0022】《DS-Link符号化》図15は、1394シリアルバスで採用されている、データ転送フォーマットのDS-Link符号化方式を説明するための図である。1394シリアルバスでは、DS-Link（Data/Strobe Link）符号化方式が採用されている。このDS-Link符号化方式は、高速なシリアルデータ通信に適しており、その構成は、2本の信号線を必要とする。より対線のうち1本に主となるデータを送り、他方のより対線にはストロブ信号を送る構成になっている。受信側では、この通信されるデータと、ストロブとの排他的論理和をとることによってクロックを再現する。このDS-Link符号化方式を用いるメリットとして、8/10B変換に比べて転送効率が高いこと、PLL回路が不要となるのでコントローラLSIの回路規模を小さくできること、更には、転送すべきデータが無いときにアイドル状態であることを示す情報を送る必要が無いので、各機器のトランシーバ回路をスリープ状態にすることができることによって、消費電力の低減が図れる、などが挙げられる。

【0023】《バスリセットのシーケンス》1394シリアルバスでは、接続されている各機器（ノード）にはノードIDが与えられ、ネットワーク構成として認識されている。このネットワーク構成に変化があったとき、例えばノードの挿抜や電源のON/OFFなどによるノード数の増減などによって変化が生じて、新たなネットワーク構成を認識する必要があるとき、変化を検知した各ノードはバス上にバスリセット信号を送信して、新たなネットワーク構成を認識するモードに入る。このときの変化の検知方法は、1394ポート基板上でのバイアス電圧の変化を検知することによって行われる。

【0024】あるノードからバスリセット信号が伝達されると、各ノードのフィジカルレイヤはこのバスリセッ

ト信号を受けると同時にリンクレイヤにバスリセットの発生を伝達し、かつ他のノードにバスリセット信号を伝達する。最終的にすべてのノードがバスリセット信号を検知した後、バスリセットが起動される。バスリセットは、先に述べたようなケーブル抜挿や、ネットワーク異常等によるハード検出によって起動されるが、プロトコルからのホスト制御などによってフィジカルレイヤに直接命令を出すことによっても起動される。また、バスリセットが起動するとデータ転送は一時中断され、データ転送は当該バスリセットの処理の待たされることになる。そして、バスリセットの終了後、新しいネットワーク構成のもとで再開される。以上がバスリセットのシーケンスである。

【0025】《ノードID決定のシーケンス》バスリセットの後、各ノードは新しいネットワーク構成を構築するために、各ノードにIDを与える動作に入る。このときの、バスリセットからノードID決定までの一般的なシーケンスを図23、24、25のフローチャートを用いて説明する。

【0026】図23は、バスリセットの発生からノードIDが決定し、データ転送が行えるようになるまでの、一連のバスの作業を示すフローチャートである。まず、ステップS101において、ネットワーク内にバスリセットが発生することを常時監視し、ここでノードの電源ON/OFFなどによってバスリセットが発生するとステップS102に移る。ステップS102では、ネットワークがリセットされた状態から、新たなネットワークの接続状況を知るために、直接接続されている各ノード間において親子関係の宣言がなされる。ステップS103において、すべてのノード間で親子関係が決定されたと判断されると、ステップS104へ進み、一つのルートを決定する。なお、すべてのノード間で親子関係が決定するまでは、ステップS102の親子関係の宣言をおこない、またルートも決定されない。

【0027】ステップS104でルートが決定されると、ステップS105において、各ノードにIDを与えるノードIDの設定作業が行われる。所定のノード順序で、ノードIDの設定が行われ、すべてのノードにIDが与えられるまで繰り返し設定作業が行われる（ステップS106）。最終的にすべてのノードにIDを設定し終え、新しいネットワーク構成がすべてのノードにおいて認識されたことになる。よって、処理はステップS106からステップS107へ進み、ノード間のデータ転送が行える状態となり、データ転送が開始される。

【0028】そして、このステップS107の状態になると、再びバスリセットが発生するのを監視するモードに入り、バスリセットが発生したらステップS101からステップS106までの設定作業が繰り返し行われる。以上が、図23のフローチャートの説明であるが、図23のフローチャートのバスリセットからルート決定

までの部分と、ルート決定後からID設定終了までの手順を図24及び図25を参照して更に詳しく説明する。図24は、各ノードにおけるバスリセットからルート決定までの処理を説明するフローチャートである。また、図25は、ルート決定後からID設定終了までの手順を示すフローチャートである。

【0029】まず、図24を参照して説明を行う。ステップS201においてバスリセットが発生すると、ネットワーク構成は一旦リセットされ、処理はステップS202へ進む。なお、ステップS201では、バスリセットが発生するのを常に監視している。次に、ステップS202において、リセットされたネットワークの接続状況を再認識する作業の第一段階として、各機器にリーフ（ノード）であることを示すフラグを立てておく。

【0030】次に、ステップS203において、各機器が自分の持つポートがいくつ他ノードと接続されているのかを調べる。ステップS204では、ポート数に基づいて親子関係の宣言を始めていくために、未定義（親子関係が決定されていない）ポートの数を調べる。バスリセットの直後はポート数＝未定義ポート数であるが、親子関係が決定されていくにしたがって、ステップS204で検知する未定義ポートの数は変化していくものである。

【0031】まず、バスリセットの直後、はじめに親子関係の宣言を行えるのはリーフに限られている。リーフであるというのはステップS203のポート数の確認で知ることができる。即ち、リーフは、親子関係が未定義の段階で未定義ポート数が1のものである。リーフは、ステップS205において、自分に接続されているノードに対して、「自分は子、相手は親」と宣言し動作を終了する。

【0032】ステップS203でポート数が複数ありブランチと認識したノードは、バスリセットの直後はステップS204で未定義ポート数>1ということになるので、ステップS206へ移り、ブランチというフラグが立てられる。そして、ステップS207でリーフからの親子関係宣言で「親」の受付をするために待つ。リーフである他のノードが親子関係の宣言を行い、ステップS207でそれを受けたブランチは、適宜ステップS204の未定義ポート数の確認を行う。ここで、未定義ポート数が1になっていれば残っているポートに接続されているノードに対して、ステップS205の「Child（自分が子）」の宣言をすることが可能になる。2度目以降のステップS204の処理で未定義ポート数を確認しても2以上あるブランチに対しては、再度ステップS207でリーフ又は他のブランチからの「親」の受付をするために待つ。

【0033】最終的に、いずれか1つのブランチ、又は例外的にリーフ（子宣言を行えるのにすばやく動作しなかった為）がステップS204の未定義ポート数の確認

の結果としてゼロになったら、これにてネットワーク全体の親子関係の宣言が終了したものであり、未定義ポート数がゼロ（すべて親のポートとして決定）になった唯一のノードはステップS208においてルートのフラグが立てられ、ステップS209においてルートとしての認識がなされる。このようにして、図24に示したバスリセットから、ネットワーク内すべてのノード間における親子関係の宣言までが終了する。

【0034】つぎに、図25のフローチャートについて説明する。まず、図24までのシーケンスでリーフ、ブランチ、ルートという各ノードのフラグの情報が設定されているので、これを元にして、ステップS301でそれぞれ分類する。各ノードにIDを与える作業として、最初にIDの設定を行うことができるのはリーフからである。リーフ→ブランチ→ルートの順で若い番号（ノード番号=0～）からIDの設定がなされていく。

【0035】ステップS302において、ネットワーク内に存在するリーフの数N（Nは自然数）を設定する。この後、ステップS303において各リーフがルートに対してIDを与えるように要求する。この要求が複数ある場合には、ルートはステップS304においてアービトレーションを行い、ステップS305において勝ったノード1つにID番号を与え、負けたノードには失敗の結果通知を行う。ステップS306においてID取得が失敗に終わったリーフは、再度ID要求を出し、同様の作業を繰り返す。

【0036】IDを取得できたリーフはステップS307においてそのノードのID情報をブロードキャストで全ノードに転送する。1ノードID情報のブロードキャストが終わると、ステップS308において残りのリーフの数Nが1つ減らされる。ここで、ステップS309において、この残りのリーフの数Nが1以上ある場合はステップS303からのID要求の作業を繰り返し行う。そして、最終的にすべてのリーフがID情報をブロードキャストすると、ステップS309においてN=0となり、ブランチのID設定のためにステップS310に移る。

【0037】ブランチのID設定もリーフの時と同様に行われる。まず、ステップS310においてネットワーク内に存在するブランチの数M（Mは自然数）を設定する。この後、ステップS311として各ブランチがルートに対して、IDを与えるように要求する。これに対してルートは、ステップS312においてアービトレーションを行い、勝ったブランチから順に、リーフに与え終わった番号の次に若い番号から与えていく。ステップS313において、ルートは要求を出したブランチにID情報又は失敗結果を通知する。ステップS314において、ID取得が失敗に終わったブランチは、再度ID要求を出し、同様の作業を繰り返す。

【0038】IDを取得できたブランチからステップS

315へ進み、そのノードのID情報をブロードキャストで全ノードに転送する。1ノードID情報のブロードキャストが終わると、ステップS316において、残りのブランチの数Mが1つ減らされる。ここで、ステップS317において、この残りのブランチの数Mが1以上ある場合はステップS311からのID要求の作業を繰り返し、最終的にすべてのブランチがID情報をブロードキャストするまで行われる。すべてのブランチがノードIDを取得すると、ステップS317においてM=0となり、ブランチのID取得モードが終了する。

【0039】ここまで終了すると、最終的にID情報を取得していないノードはルートのみなので、ステップS318において与えていない番号で最も若い番号を自分のID番号と設定し、ステップS319としてルートのID情報をブロードキャストする。以上で、図25に示したように、親子関係が決定した後から、すべてのノードのIDが設定されるまでの手順が終了する。

【0040】次に、一例として、図16に示した実際のネットワークにおけるバスリセット時のネットワーク構築動作を説明する。図16は、バスリセット時のネットワーク構築動作を説明するための図である。図16において、ノードB（ルート）の下位にはノードAとノードCが直接接続されており、更にノードCの下位にはノードDが直接接続されており、更にノードDの下位にはノードEとノードFが直接接続された階層構造になっている。このような、階層構造やルートノード、ノードIDを決定する手順を以下で説明する。

【0041】バスリセットがされた後、まず各ノードの接続状況を認識するために、各ノードの直接接続されているポート間において、親子関係の宣言がなされる。この親子とは親側が階層構造で上位となり、子側が下位となる言うことができる。図16ではバスリセットの後、最初に親子関係の宣言を行なったのはノードAである。基本的にノードの1つのポートにのみ接続があるノード（リーフと呼ぶ）から親子関係の宣言を行なうことができる。これは、自分には1ポートの接続のみしかない、ということをもとに知ることができるので、これによってネットワークの端であることを認識し、その中で早く動作を行なったノードから親子関係が決定されていく。こうして親子関係の宣言を行なった側（A-B間ではノードA）のポートが子と設定され、相手側（ノードB）のポートが親と設定される。こうして、ノードA-B間では子-親、ノードE-D間で子-親、ノードF-D間で子-親と決定される。

【0042】さらに1階層あがって、今度は複数個接続ポートを持つノード（ブランチと呼ぶ）のうち、他ノードからの親子関係の宣言を受けたものから順次、更に上位に親子関係の宣言を行なっていく。図16ではまずノードDがD-E間、D-F間と親子関係が決定した後、ノードCに対する親子関係の宣言を行っており、その結

果ノードD-C間で子-親と決定している。

【0043】ノードDからの親子関係の宣言を受けたノードCは、もう一つのポートに接続されているノードBに対して親子関係の宣言を行なっている。これによってノードC-B間で子-親と決定している。このようにして、図16のような階層構造が構成され、最終的に、接続されているすべてのポートにおいて親となったノードBが、ルートノードと決定されることになる。ルートは1つのネットワーク構成中に一つしか存在しないものである。

【0044】なお、この図16においてノードBがルートノードと決定されたが、これはノードAから親子関係宣言を受けたノードBが、他のノードに対して親子関係宣言を早いタイミングで行なっていれば、ルートノードは他ノードに移っていたこともあり得る。すなわち、伝達されるタイミングによってはどのノードもルートノードとなる可能性があり、同じネットワーク構成でもルートノードは一定とは限らない。

【0045】ルートノードが決定すると、次は各ノードIDを決定するモードに入る。ここではすべてのノードが、決定した自分のノードIDを他のすべてのノードに通知する（ブロードキャスト機能）。自己ID情報は、自分のノード番号、接続されている位置の情報、持っているポートの数、接続のあるポートの数、各ポートの親子関係の情報等を含んでいる。

【0046】ノードID番号の割り振りの手順としては、まず1つのポートにのみ接続があるノード（リーフ）から起動することができ、この中から順にノード番号=0、1、2...と割り当てられる。ノードIDを獲得したノードは、ノード番号を含む情報をブロードキャストで各ノードに送信する。これによって、そのID番号は『割り当て済み』であることが認識される。

【0047】すべてのリーフが自己ノードIDを取得し終ると、次はブランチへ移りリーフに引き続いたノードID番号が各ノードに割り当てられる。リーフと同様に、ノードID番号が割り当てられたブランチから順次ノードID情報をブロードキャストし、最後にルートノードが自己ID情報をブロードキャストする。すなわち常にルートは最大のノードID番号を所有するものである。

【0048】以上のようにして、階層構造全体のノードIDの割り当てが終わり、ネットワーク構成が再構築され、バスの初期化作業が完了する。

《アービトレーション》1394シリアルバスでは、データ転送に先立って必ずバス使用権のアービトレーション（調停）を行なう。1394シリアルバスは個別に接続された各機器が、転送された信号をそれぞれ中継することによって、ネットワーク内すべての機器に同信号を伝えるように、論理的なバス型ネットワークであるので、パケットの衝突を防ぐ意味でアービトレーションは

必要である。これによってある時間には、たった一つのノードのみ転送を行なうことができる。

【0049】図17は1394紙リアルバスにおけるアービトレーションを説明する図である。特に、図17の(a)はバス使用要求の流れを示し、図17の(b)はバス使用許可の流れを示す。アービトレーションが始まると、1つもしくは複数のノードが親ノードに向かって、それぞれバス使用権の要求を発する。図17(a)のノードCとノードFがバス使用権の要求を発しているノードである。これを受けた親ノード（図17ではノードA）は更に親ノードに向かって、バス使用権の要求を発する（中継する）。この要求は最終的に調停を行なうルートに届けられる。

【0050】バス使用要求を受けたルートノード（ノードB）は、どのノードにバスを使用させるかを定める。この調停作業はルートノードのみが行なえるものであり、調停によって勝ったノードにはバスの使用許可が与えられる。図17の(b)ではノードCに使用許可が与えられ、ノードFの使用要求は拒否されたことを示している。アービトレーションに負けたノードに対してはDP（data prefix）パケットを送り、要求が拒否されたことを知らせる。要求が拒否されたノードのバス使用要求は次のアービトレーションまで待たされる。

【0051】以上のようにして、アービトレーションに勝ってバスの使用許可を得たノードは、以降データの転送を開始できる。ここで、アービトレーションの一連の流れをフローチャート図26を参照して説明する。図26はアービトレーションの処理手順を表すフローチャートである。ノードがデータ転送を開始できる為には、バスがアイドル状態であることが必要である。先に行われていたデータ転送が終了して、現在バスが空き状態であることを認識するためには、各転送モードで個別に設定されている所定のアイドル時間ギャップ長（例、サブアクション・ギャップ）を経過する事によって、各ノードは自分の転送が開始できると判断する。

【0052】ステップS401において、Asyncデータ、Isoデータ等それぞれ転送するデータに応じた所定のギャップ長が得られたか判断する。所定のギャップ長が得られない限り、転送を開始するために必要なバス使用権の要求はできないので、所定のギャップ長が得られるまで待つ。ステップS401で所定のギャップ長が得られたら、ステップS402において転送すべきデータがあるかを判断し、あればステップS403へ進む。

【0053】ステップS403では、データ転送をするためにバスを確保するよう、バス使用権の要求をルートに対して発する。このときの、バス使用権の要求を表す信号の伝達は、図17の(a)に示したように、ネットワーク内の各機器を中継しながら、最終的にルートに届けられる。一方、ステップS402で転送するデータがない場合は、そのまま待機する。次に、ステップS40

4において、ルートノードはステップS403で発行されたバス使用要求を受信する。そして、ステップS405において、ルートは使用要求を出したノードの数を調べる。ステップS405で使用要求を出したノードの数が1（使用権要求を出したノードが1つ）だったら、そのノードに直後のバス使用許可が与えられることとなる。一方、ステップS405において、ノード数>1（使用要求を出したノードは複数）だったら、ルートはステップS406において使用許可を与えるノードを1つに決定する調停作業を行う。この調停作業は公平なものであり、毎回同じノードばかりが許可を得る様なことはなく、平等に権利を与えていくような構成となっている（フェア・アービトレーション）。

【0054】次に、ステップS407において、ステップS406で使用要求を出した複数ノードの中からルートが調停して使用許可を得た1つのノードと、敗れたその他のノードに分ける選択を行う。ここで、調停されて使用許可を得た1つのノード、またはステップS405において使用要求ノード数=1で調停無しに使用許可を得たノードには、ステップS408として、ルートはそのノードに対して許可信号を送る。許可信号を得たノードは、受け取った直後に転送すべきデータ（パケット）を転送開始する。また、ステップS406の調停で敗れて、バス使用が許可されなかったノードには、ステップS409において、ルートから、アービトレーション失敗を示すDP（data prefix）パケットを送られ、これを受け取ったノードは再度転送を行うためのバス使用要求を出すため、ステップS401まで戻り、所定ギャップ長が得られるまで待機する。

【0055】以上が1394シリアルバスによるアービトレーションの流れである。

《アシンクロナス（Asynchronous、非同期）転送》アシンクロナス転送は、非同期転送である。図18はアシンクロナス転送における時間的な遷移状態を示す図である。図18の最初のサブアクション・ギャップは、バスのアイドル状態を示すものである。このアイドル時間が一定値になった時点で、転送を希望するノードはバスが使用できると判断してバス使用要求を発行し、バス獲得のためのアービトレーションが実行される。

【0056】アービトレーションでバスの使用許可を得ると、次にデータの転送がパケット形式で実行される。データ転送後、当該データを受信したノードは、転送されたデータに対しての受信結果のack（受信確認用返送コード）をack gapという短いギャップの後、返送して応答するか、応答パケットを送ることによって転送が完了する。ackは4ビットの情報と4ビットのチェックサムからなり、成功か、ビジー状態か、ペンディング状態であるかといった情報を含み、すぐに送信元ノードに返送される。

【0057】次に、アシンクロナス転送のパケットフォ

ーマットを説明する。図19はアシンクロナス転送のパケットフォーマットの例を示す図である。パケットには、データ部及び誤り訂正用のデータCRCの他にヘッダ部がある。ヘッダ部には図19に示したような、目的ノードID、ソースノードID、転送データ長さや各種コードなどが書き込まれ、転送が行なわれる。また、アシンクロナス転送は自己ノードから相手ノードへの1対1の通信である。転送元ノードから転送されたパケットは、ネットワーク中の各ノードに行き渡るが、自分宛てのアドレス以外のものは無視されるので、宛先の1つのノードのみが読込むことになる。以上がアシンクロナス転送の説明である。

【0058】《アイソクロナス（Isochronous、同期）転送》アイソクロナス転送は同期転送である。1394シリアルバスの最大の特徴であるともいえるこのアイソクロナス転送は、特に映像データや音声データといったマルチメディアデータなど、リアルタイムな転送を必要とするデータの転送に適した転送モードである。また、アシンクロナス転送（非同期）が1対1の転送であったのに対し、このアイソクロナス転送はブロードキャスト機能によって、転送元の1つのノードから他のすべてのノードへ一様にデータが転送される。

【0059】図20はアイソクロナス転送における、時間的な遷移状態を示す図である。アイソクロナス転送は、バス上一定時間毎に実行される。この時間間隔をアイソクロナスサイクルと呼ぶ。アイソクロナスサイクル時間は、125μsである。この各サイクルの開始時間を示し、各ノードの時間調整を行なう役割を担っているのがサイクル・スタート・パケットである。サイクル・スタート・パケットを送信するのは、サイクル・マスタと呼ばれるノードであり、1つ前のサイクル内のデータ転送終了後、所定のアイドル期間（サブアクションギャップ）を経た後、本サイクルの開始を告げるサイクル・スタート・パケットを送信する。このサイクル・スタート・パケットの送信される時間間隔が125μsとなる。

【0060】また、図20にチャンネルA、チャンネルB、チャンネルCと示したように、1サイクル内において複数種のパケットがチャンネルIDをそれぞれ与えられることによって、区別して転送できる。これによって同時に複数ノード間でのリアルタイムな転送が可能であり、また受信するノードでは自分が欲しいチャンネルIDのデータのみを取り込む。このチャンネルIDは送信先のアドレスを表すものではなく、データに対する論理的な番号を与えているに過ぎない。よって、あるパケットの送信は1つの送信元ノードから他のすべてのノードに行き渡る、ブロードキャストで転送されることになる。

【0061】アイソクロナス転送のパケット送信に先立って、アシンクロナス転送同様アービトレーションが行われる。しかし、アシンクロナス転送のように1対1の

通信ではないので、アイソクロナス転送にはack(受信確認用返信コード)は存在しない。また、図20に示した iso gap(アイソクロナスギャップ)とは、アイソクロナス転送を行なう前にバスが空き状態であると認識するために必要なアイドル期間を表している。この所定のアイドル期間を経過すると、アイソクロナス転送を行ないたいノードはバスが空いていると判断し、転送前のアービトレーションを行なうことができる。

【0062】つぎに、アイソクロナス転送のパケットフォーマットについて説明する。図21はアイソクロナス転送のパケットフォーマットの例を示す図である。各チャンネルに分かれた、各種のパケットにはそれぞれデータ部及び誤り訂正用のデータCRCの他に、ヘッダ部がある。そのヘッダ部には図21に示したような、転送データ長やチャンネルNO.、その他各種コード及び誤り訂正用のヘッダCRCなどが書き込まれ、転送が行なわれる。以上がアイソクロナス転送の説明である。

【0063】《バス・サイクル》実際の1394シリアルバス上の転送では、アイソクロナス転送と、アシンクロナス転送は混在できる。図22は、アイソクロナス転送とアシンクロナス転送とが混在した、バス上の転送状態の時間的な遷移の様子を表した図である。アイソクロナス転送はアシンクロナス転送より優先して実行される。その理由は、サイクル・スタート・パケットの後、アシンクロナス転送を起動するために必要なアイドル期間のギャップ長(サブアクションギャップ)よりも短いギャップ長(アイソクロナスギャップ)で、アイソクロナス転送を起動できるからである。したがって、アシンクロナス転送より、アイソクロナス転送は優先して実行されることとなる。

【0064】図22に示した一般的なバスサイクルにおいて、サイクル#mのスタート時にサイクル・スタート・パケットがサイクル・マスタから各ノードに転送される。これによって、各ノードで時刻調整を行ない、所定のアイドル期間(アイソクロナスギャップ)を待ってからアイソクロナス転送を行なうべきノードはアービトレーションを行い、パケット転送に入る。図22ではチャンネルeとチャンネルsとチャンネルkが順にアイソクロナス転送されている。

【0065】このアービトレーションからパケット転送までの動作を、与えられているチャンネル分繰り返した後、サイクル#mにおけるアイソクロナス転送がすべて終了したら、アシンクロナス転送を行うことができるようになる。アイドル時間がアシンクロナス転送が可能なサブアクションギャップに達することによって、アシンクロナス転送を行いたいノードはアービトレーションの実行に移れると判断する。ただし、アシンクロナス転送が行える期間は、アイソクロナス転送終了後から、次のサイクル・スタート・パケットを転送すべき時間(cycle synch)までの間に、アシンクロナス転送を起

動するためのサブアクションギャップが得られた場合に限っている。

【0066】図22のサイクル#mでは3つのチャンネル分のアイソクロナス転送と、その後アシンクロナス転送(ackを含む)が2パケット(パケット1、パケット2)転送されている。このアシンクロナスパケット2の後、サイクルm+1をスタートすべき時間(cycle synch)にいたるので、サイクル#mでの転送はここまでで終わる。

【0067】ただし、非同期または同期転送動作中に次のサイクル・スタート・パケットを送信すべき時間(cycle synch)に至ったとしたら、無理に中断せず、その転送が終了した後のアイドル期間を待ってから次サイクルのサイクル・スタート・パケットを送信する。すなわち、1つのサイクルが125 $\mu$ s以上続いたときは、その分次サイクルは基準の125 $\mu$ sより短縮されたとする。このようにアイソクロナス・サイクルは125 $\mu$ sを基準に超過、短縮し得るものである。しかし、アイソクロナス転送はリアルタイム転送を維持するために毎サイクル必要であれば必ず実行され、アシンクロナス転送はサイクル時間が短縮されたことによって次以降のサイクルにまわされることもある。こういった遅延情報も含めて、サイクル・マスタによって管理される。

【0068】<実施形態1>本発明の実施形態1では、画像処理装置と出力装置とが接続され、その画像処理装置で処理された画像データに基づく画像を出力装置で出力する画像処理システムにおいて、画像処理装置としてデジタルカメラ、出力装置としてプリンタで構成した図4に示すような画像処理システムを例に挙げて説明する。

【0069】まず、デジタルカメラの機能構成及びその動作について、図2を用いて説明する。図2は本発明の実施形態1のデジタルカメラの機能構成を示すブロック図である。尚、ここでは、図1に示した画像データに対応する画像を記録する場合を例に挙げて説明する。

【0070】まず、レンズ系21より得られる画像はCCD素子22面上に結像される。CCD素子22より得られたアナログ信号は、A/D変換部23によりデジタル信号へと変換される。変換されたデジタル信号は、画像処理部24へと送信され、色変換処理、エッジ強調処理、ガンマ補正処理等の画像処理が施された画像データに変換される。次に、画像データは画像変換部25へと送信される。画像変換部25では、プリンタの記録ヘッドの1走査によって記録可能な画素数幅毎に画像データが分割され、分割された画像データ毎にJPEG圧縮されてデータ記録部26に記録される。

【0071】尚、画像データのデータ記録部26への記録の管理は、データ記録部26のアドレスに基づいて行われる。例えば、プリンタの記録に用いる1枚の記録媒体分の画像データAが3つの画像データA1、A2、A

3に分割されてJ P E G圧縮されている場合、画像データA 1、A 2、A 3が記録されているデータ記録部26のそれぞれの先頭アドレスが、データ記録部26内のアドレス管理部（不図示）によって管理される。

【0072】以上のような処理を画像データB、画像データCに対しても実行する。この場合、画像データBは、画像データB 1、B 2、B 3に分割されJ P E G圧縮されてデータ記録部26へ記録され、画像データCは画像データC 1、C 2、C 3に分割されJ P E G圧縮されてデータ記録部26へ記録される。次に、上記のデジタルカメラに接続されたプリンタの機能構成及び動作について、図3を用いて説明する。

【0073】尚、実施形態1のプリンタは、インクジェット方式による記録ヘッドを搭載したインクジェットプリンタであるとし、記録ヘッドは、その走査方向（ピクセル方向）及び記録ヘッドの走査方向とは垂直な方向、つまり、記録媒体の搬送方向（ライン方向）にそれぞれ64個のノズルが配置されているとする。また、各ノズルは画像データの1画素に対応し、記録媒体はA4サイズのカットシートを用いるとする。

【0074】図3は本発明の実施形態1のプリンタの機能構成を示すブロック図である。ユーザは、まず、プリンタ上にあるインタフェース部31により、デジタルカメラ内のデータ記録部26に記録された画像データをいくつ記録するか、どの画像データを記録するか等のプリンタで記録する画像データの選択を行う。尚、プリンタで記録する画像データの選択は、詳述しないが、デジタルカメラにディスプレイがあれば、そのディスプレイ上にデータ記録部26に記録されている画像データを表示して選択しても良いし、データ記録部26に記録される画像データのインデックスプリントを使用して選択しても良い。

【0075】ここでは、データ記録部26に記録されている画像データAをA4サイズの記録媒体に1枚記録する場合を例に挙げて説明する。プリンタで記録する画像データ（画像データA）を選択すると、プリンタはインタフェース部31からデジタルカメラへ画像データを得るためのリクエスト信号を送信する。リクエスト信号は、デジタルカメラのインタフェース部27に送信される。そして、デジタルカメラはそのリクエスト信号に答えるべく、画像データAを分割しJ P E G圧縮した画像データの1つをプリンタへ送信する。

【0076】尚、上述したように、画像データAを分割する分割単位は、プリンタの記録ヘッドの1走査で記録可能な画素数幅で決定される。例えば、画像データAが832画素（ライン）×640画素（ピクセル）である場合は、記録ヘッドのピクセル方向のノズルの数（画素数）が64であるので、画像データAは832画素（ライン）×64画素（ピクセル）単位で分割される。即ち、画像データAは、画像データA 1、A 2、A 3、

…、A 9、A 10の10個に分割された後、それぞれがJ P E G圧縮されデータ記録部26に記録されている。

【0077】また、記録ヘッドの1走査で記録可能な画素数は、ユーザが予めデジタルカメラのインタフェース部27より設定するか、あるいはデジタルカメラのデータ記録部26に記録されている画像データをプリンタへ送信する前に、プリンタがデジタルカメラに対して通知するような構成にしても良い。また、あるいは、後述する実施形態3のように、予めデフォルト値として設定していても良い。

【0078】次に、プリンタがデジタルカメラより受信したJ P E G圧縮された画像データ（例えば、画像データA 1）は、J P E G解凍処理部32へと送信される。そして、J P E G解凍処理部32でJ P E G圧縮された画像データA 1がJ P E G解凍される。J P E G解凍された画像データA 1は、プリント画像処理部33によって、色変換処理、2値化処理がなされる。2値化された画像データA 1は、記録位置制御処理部34へと送信され、記録媒体上の記録すべき位置が管理される。

【0079】尚、記録位置制御処理部34における位置制御は、2値化された画像データに対応するバッファメモリ36の書き込み位置を制御することによって行われる。次に、位置制御された2値化された画像データは、ヘッド駆動信号変換部35へと送信され、記録ヘッドを動作させるための記録信号へと変換される。次に、記録信号はバッファメモリ36に一旦格納される。そして、記録位置制御処理部34による位置制御に基づいて、記録信号は順次プリンタエンジン37に送信され、その記録信号に基づく画像が記録媒体上に記録される。

【0080】以上が実施形態1のプリンタの記録ヘッドの1走査による記録手順である。記録ヘッドの1走査による記録が完了すると、再び、プリンタのインタフェース部31により、次の記録ヘッドの1走査の記録に必要な画像データをデジタルカメラから得るために、デジタルカメラへリクエスト信号が送信される。デジタルカメラでは、プリンタよりリクエスト信号を受信すると、プリンタの次の記録ヘッドの1走査に必要なJ P E G圧縮された画像データ（ここでは、画像データA 2）をプリンタへ送信する。そして、上述した同様の記録手順によって、デジタルカメラより受信したJ P E G圧縮された画像データA 2に対応する画像が、記録媒体上に記録される。

【0081】以上のような記録手順を、分割された圧縮された画像データに対し順次行い、画像データA 10に対応する画像が記録媒体上に記録されると、画像データAに対応する画像の記録が完了する。次に、記録ヘッドの走査方向に複数の画像を記録する場合の記録手順について説明する。尚、説明を簡単にするために、プリンタが選択する記録する画像データは、上述した画像データAと、画像データAと同サイズの画像データBが選択さ

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れ、また、図 6 に示すように記録ヘッドの走査方向に、画像データ A に対応する画像 A、画像データ B に対応する画像 B を記録するように設定されているものとする。

【0082】まず、デジタルカメラより入力された画像 A に対応する画像データ A、画像 B に対応する画像データ B は、上述した同様の記録手順で、記録ヘッドの 1 走査で記録可能な画素数幅毎に分割され J P E G 圧縮されて、データ記録部 26 に記録される。続いて、プリンタより記録に必要な画像データのリクエスト信号がデジタルカメラへ送信される。プリンタよりリクエスト信号を受信したデジタルカメラは、プリンタの最初の記録ヘッドの 1 走査に必要な画像データとして、J P E G 圧縮された画像データ A 1、続いて、J P E G 圧縮された画像データ B 1 をプリンタへ送信する。

【0083】そして、プリンタは、J P E G 圧縮された画像データ A 1 をデジタルカメラより受信し、上述の記録手順を経てバッファメモリ 36 の所定の位置に一旦格納する。続いて、J P E G 圧縮された画像データ B 1 を受デジタルカメラより受信し、同様の記録手順によって、バッファメモリ 36 の画像データ A 1 が格納されている位置とは異なる位置に一旦格納する。バッファメモリ 36 に画像データ A 1 と画像データ B 1 が格納されると、記録位置制御処理部 34 の位置制御に基づいて、順次プリンタエンジン 37 に送信され対応する画像が記録媒体上に記録される。

【0084】以上のような記録手順を、画像データ A 2、画像データ B 2、画像データ A 3、画像データ B 3、…、画像データ A 10、画像データ B 10 に対し順次行い、画像データ A 10、画像データ B 10 に対応する画像が記録媒体上に記録されると、画像データ A に対応する画像 A、画像データ B に対応する画像 B の記録が完了する。

【0085】尚、実施形態 1 では、デジタルカメラのデータ記録部 26 に記録されている画像データをプリンタに接続して対応する画像を出力する構成について説明したが、図 5 に示すようにパーソナルコンピュータに接続して対応する画像をパーソナルコンピュータのモニタに出力することができることは言うまでもない。また、複数の画像を記録する例として、2 つの画像 A、画像 B を記録ヘッドの走査方向へ並べて記録する場合について説明したが、2 つ以上の画像を記録ヘッドの走査方向に並べて記録することも可能である。更には、図 7 に示すような記録ヘッドの走査方向及び記録媒体の搬送方向に複数の画像を並べて記録することも可能である。

【0086】更に、デジタルカメラに入力された画像に対応する画像データの圧縮方式として、J P E G 圧縮方式を用いてるが、これに限定されるものではない。以上説明したように、実施形態 1 によれば、デジタルカメラより入力した画像データを、プリンタの記録ヘッドの 1 走査で記録可能な画素数毎に分割し、その分割された画

像データを記録ヘッドの 1 走査毎に受信して記録するため、デジタルカメラからプリンタへの画像データの送信動作と、プリンタの記録動作を効率的に実行することができる。その結果、画像処理システムのトータルスループットを向上することができる。

【0087】また、プリンタの記録ヘッドの 1 走査に必要な画像データを順次受信し記録を行っていくので、記録媒体に記録する画像全体の画像データを記憶するための記憶容量を持つバッファメモリ 36 を必要としない。その結果、バッファメモリ 36 の記憶容量を低減することができる。

＜実施形態 2＞実施形態 2 では、デジタルカメラとプリンタとが接続され、デジタルカメラで入力された画像データに対応する画像のサイズを拡大あるいは縮小してプリンタで記録する画像処理システムを実施形態 2 として説明する。

【0088】尚、実施形態 2 のデジタルカメラの機能構成及び動作については、実施形態 1 の図 1 と同様であるので、ここではその詳細を省略する。次に、実施形態 2 のプリンタの機能構成及び動作について、図 8 を用いて説明する。図 8 は本発明の実施形態 2 のプリンタの機能構成を示すブロック図である。

【0089】尚、実施形態 2 のプリンタの記録ヘッドは、実施形態 1 のプリンタの記録ヘッドと同様のものを用いるとする。ユーザは、まず、プリンタ上にあるインタフェース部 31 により、デジタルカメラ内のデータ記録部 26 に記録された画像データをいくつか記録するか、どの画像データを記録するか等のプリンタで記録する画像データの選択を行うとともに、記録する画像のサイズ、拡大あるいは縮小の倍率を設定する。尚、プリンタで記録する画像データの選択及びサイズの設定は、詳述しないが、デジタルカメラにディスプレイがあれば、そのディスプレイ上にデータ記録部 26 に記録される画像データを表示して選択しても良いし、データ記録部 26 に記録される画像データのインデックスプリントを使用して選択しても良い。

【0090】ここでは、上述した実施形態 1 の画像データ A を 2 倍に拡大して A 4 サイズの記録媒体に 1 枚記録する場合を例に挙げて説明する。プリンタで記録する画像データ（画像データ A）を選択及びその記録するサイズを設定すると、プリンタはインタフェース部 81 から、デジタルカメラへ画像データを得るためのリクエスト信号を送信する。リクエスト信号は、デジタルカメラのインタフェース部 27 に送信される。そして、デジタルカメラはそのリクエスト信号に答えるべく、画像データ A を分割して J P E G 圧縮した画像データ A 1 をプリンタへ送信する。

【0091】プリンタがデジタルカメラより受信した J P E G 圧縮された画像データ A 1 は、J P E G 解凍処理部 82 へと送信される。そして、J P E G 解凍処理部 8

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2でJ P E G圧縮された画像データA1がJ P E G解凍される。J P E G解凍された画像データA1は、バッファメモリ1(83)に格納される。バッファメモリ1

(83)に格納された画像データは、プリント画像処理部84で、画像サイズの変換が行われる。ここでは、画像データを2倍に拡大するように設定されているので、バッファメモリ1(83)から画像データA1(832画素×64画素)の内、832画素×32画素分の画像データを読み出し、周知の倍率変換処理によって1664画素×64画素の画像データに拡大する。

【0092】そして、その拡大された画像データに対し、色変換処理、2値化処理がなされる。2値化された画像データは、記録位置制御処理部85へと送信され、記録媒体上の記録すべき位置が管理される。尚、記録位置制御処理部85における位置制御は、2値化された画像データに対応するバッファメモリ2(87)の書き込み位置を制御することによって行われる。そして、位置制御された2値化された画像データは、ヘッド駆動信号変換部86へと送信され、記録ヘッドを動作させるための記録信号へと変換される。次に、記録信号はバッファメモリ2(87)に一旦格納される。そして、記録位置制御処理部85による位置制御に基づいて、記録信号は順次プリンタエンジン88に送信され、その記録信号に基づく画像が記録される。

【0093】次に、バッファメモリ1(83)に格納されている画像データA1の残りの832画素×32画素分の画像データを、同様の手順によって、記録媒体上の記録すべき位置に記録する。バッファメモリ1(83)に格納されている画像データがすべて記録されたら、プリンタは次の画像データA2のリクエスト信号をデジタルカメラへと送信する。そして、デジタルカメラから次の画像データA2を受信したら、画像データA1に対して行った同様の手順によって、記録媒体上の記録すべき位置に画像データA2に対応する画像を記録する。以上のような記録手順を、分割された圧縮された画像データに対し順次行い、画像データA10に対応する画像が記録媒体上に記録されると、画像データAに対応する画像の記録が完了する。次に画像データAを1/2倍に縮小してA4サイズの記録媒体に1枚記録する場合について説明する。

【0094】プリンタで記録する画像データ(画像データA)を選択及びその記録するサイズを設定すると、プリンタはインタフェース部81からデジタルカメラへ画像データを得るためのリクエスト信号を送信する。リクエスト信号は、デジタルカメラのインタフェース部27に送信される。そして、デジタルカメラはそのリクエスト信号に答えるべく、画像データAを分割してJ P E G圧縮した画像データA1をプリンタへ送信する。プリンタがデジタルカメラより受信したJ P E G圧縮された画像データA1は、J P E G解凍処理部82へと送信され

る。そして、J P E G解凍処理部82でJ P E G圧縮された画像データA1がJ P E G解凍される。J P E G解凍された画像データA1は、バッファメモリ83に格納される。バッファメモリ1(83)に格納された画像データは、プリント画像処理部84で、画像サイズの変換が行われる。ここでは、画像データを1/2倍に縮小するように設定されているので、バッファメモリ1(83)から画像データA1(832画素×64画素)を読み出し、周知の倍率変換処理によって416画素×32画素の画像データに縮小する。そして、その縮小された画像データに対し、色変換処理、2値化処理がなされる。2値化された画像データは、記録位置制御処理部85へと送信され、記録媒体上の記録すべき位置が管理される。位置制御された2値化された画像データは、ヘッド駆動信号変換部86へと送信され、記録ヘッドを動作させるための記録信号へと変換される。次に、記録信号はバッファメモリ2(87)に一旦格納される。

【0095】次に、同様の手順によって、デジタルカメラより画像データA2を受信し、バッファメモリ2(87)の画像データA1に対応する記録信号が格納されている位置の後に画像データA2に対応する記録信号を格納する。画像データA1、A2それぞれに対応する2つの記録信号がバッファメモリ2(87)に格納されると、それぞれの記録信号は、記録位置制御処理部85による位置制御に基づいて、順次プリンタエンジン88に送信され、その記録信号に基づく画像が記録媒体上に記録される。

【0096】以上が、画像データを1/2倍に縮小して記録する場合の記録ヘッドの1走査による記録手順である。記録ヘッドの1走査による記録が終了すると、再び、プリンタのインタフェース部81により、次の記録ヘッドの1走査の記録に必要な画像データをデジタルカメラから得るために、デジタルカメラへリクエスト信号が送信される。デジタルカメラでは、プリンタよりリクエスト信号を受信すると、プリンタの次の記録ヘッドの走査に必要なJ P E G圧縮された画像データ(ここでは、画像データA3、A4)をプリンタへ送信する。そして、上述した同様の記録手順によって、デジタルカメラより受信したJ P E G圧縮された画像データA3、A4に対応する画像が、記録媒体上の記録すべき位置に記録される。以上のような記録手順を、分割された圧縮された画像データに対し順次行い、画像データA10に対応する画像が記録媒体上に記録されると、画像データAに対応する画像の記録が完了する。尚、実施形態2では、記録する画像データのサイズとして2倍に拡大して記録する場合と、1/2倍に縮小して記録する場合を例に挙げて説明したが、3倍、4倍に拡大して記録、1/3倍、1/4倍に縮小して記録する場合においても、同様の手順で対応できる。また、ここでは、記録媒体に1つの画像を記録する場合について説明したが、実施形態

1で説明したように、複数の画像を記録媒体上に記録することも可能である。以上説明したように、実施形態2によれば、デジタルカメラで入力された画像データのサイズを変更し、その変更された画像データに対応する画像をプリンタで記録する場合にも、実施形態1と同様の効果を得ることができる。

【0097】<実施形態3>実施形態1、実施形態2では、デジタルカメラより入力された画像データを分割する単位である画素数幅を、ユーザあるいはプリンタより入力する構成であったが、これを予め決定されたデフォルト値を用いても良い。以下、分割する単位である画素数幅がデフォルトで決定されているデジタルカメラとプリンタが接続され、デジタルカメラで入力された画像データに対応する画像をプリンタで記録する画像処理システムを実施形態3として説明する。

【0098】尚、実施形態3のデジタルカメラ及びプリンタの機能構成及び動作については、実施形態2と同様であるので、ここではその詳細を省略する。また、一般的に、プリンタの記録ヘッドのノズル数はデータ制御の問題上、8の倍数となる。すなわち、記録ヘッドの1走査で記録可能となる画素数幅は8の倍数となる。そのため、デジタルカメラ内で予め決定されている画像データを分割する単位である画素数幅は8の倍数に設定される。また、画像データに対するJPEG圧縮の圧縮単位が8画素×8画素であることから、画素数幅を8の倍数に設定することが好ましい。

【0099】ここでは、デジタルカメラ内で予め決定されている画像データを分割する単位である画素数幅が32であり、上述した実施形態1の画像データAをA4サイズの記録媒体に1枚記録する場合を例に挙げて説明する。まず、デジタルカメラにおいて、データ記録部26に記録されている画像データAのサイズが832画素×640画素であるので、画像データAは832画素×32画素毎の画像データA1、A2、…A20の20個に分割されてJPEG圧縮されデータ記録部26に記録される。そして、プリンタのインタフェース部31より画像データを得るためのリクエスト信号がデジタルカメラへ送信されると、デジタルカメラは画像データの分割単位である画素数幅（ここでは、32）をプリンタへ送信する。プリンタはその画素数幅と記録ヘッドの1走査で記録可能な画素数幅を比較し、その比較結果に基づいて、1度にデジタルカメラより受信することができる分割されJPEG圧縮された画像データの数を決定する。

（実施形態3では、記録ヘッドの1走査で記録可能な画素数幅が64であるため、2つの分割され圧縮された画像データが必要となる。）

そこで、プリンタはJPEG圧縮された画像データA1をデジタルカメラより受信し、その受信したJPEG圧縮された画像データA1は、JPEG解凍処理部82へと送信される。そして、JPEG解凍処理部32でJP

EG圧縮された画像データA1がJPEG解凍される。JPEG解凍された画像データA1は、バッファメモリ1（83）に格納される。続いて、JPEG圧縮された画像データA2をデジタルカメラより受信し、同様の手順で、バッファメモリ1（83）へ格納する。そのバッファメモリ1（83）に格納された画像データに対し、色変換処理、2値化処理がなされる。2値化された画像データは、記録位置制御処理部85へと送信され、記録媒体上の記録すべき位置が管理される。

【0100】次に、位置制御された2値化された画像データは、ヘッド駆動信号変換部86へと送信され、記録ヘッドを動作させるための記録信号へと変換される。次に、記録信号はバッファメモリ2（87）に一旦格納される。そして、記録位置制御処理部85による位置制御に基づいて、記録信号は順次プリンタエンジン88に送信され、その記録信号に基づく画像が記録媒体上に記録される。

【0101】以上が、デジタルカメラ内の画像データを分割する単位である画素数幅が予め決定されている場合の記録ヘッドの1走査による記録手順である。記録ヘッドの1走査による記録が終了すると、再び、プリンタのインタフェース部81により、次の記録ヘッドの1走査の記録に必要な画像データをデジタルカメラから得るために、デジタルカメラへリクエスト信号が送信される。デジタルカメラでは、プリンタよりリクエスト信号を受信すると、プリンタの次の記録ヘッドの走査に必要なJPEG圧縮された画像データ（ここでは、画像データA3、A4）をプリンタへ送信する。そして、上述した同様の記録手順によって、デジタルカメラより受信したJPEG圧縮された画像データA3、A4に対応する画像が、記録媒体上の記録すべき位置に記録される。

【0102】以上のような記録手順を、分割された圧縮された画像データに対し順次行い、画像データA20に対応する画像が記録媒体上に記録されると、画像データAに対応する画像の記録が完了する。尚、実施形態3では、デジタルカメラ内の画像データを分割する単位である画素数幅は32で予め決定されていたが、8の倍数であればこれに限られるものではない。

【0103】以上説明したように、実施形態3によれば、デジタルカメラ内の画像データを分割する単位である画素数幅が予め決定されている場合でも、その画素数幅とプリンタの記録ヘッドの1走査で記録可能な画素数幅とを比較することで、記録ヘッドの1走査に必要な画像データを受信できる。そのため、このような場合にも、実施形態1と同様の効果を得ることができる。

【0104】尚、本発明の画像処理システムのデジタルカメラ内で画像データを分割する分割単位である画素数幅の決定方法は、ユーザからの入力あるいはプリンタの記録ヘッドの1走査で記録可能な画素数幅から獲得する方法と、デジタルカメラ内で予め決定しておく方法の2

つに大別される。この観点に着目すると、実施形態 1、2 は、分割単位である画素数幅をユーザからの入力あるいはプリンタより獲得する方法、実施形態 3 がデジタルカメラ内で予め画素数幅を決定しておく方法に該当する。

【0105】そこで、本発明の画像処理システムで実行される処理の概要として、実施形態 1、2 における画像処理システムで実行される処理と、実施形態 3 における画像処理システムで実行される処理について、図 9、図 10 のフローチャートを用いて説明する。まず、実施形態 1、2 における画像処理システムで実行される処理の概要について、図 9 を用いて説明する。

【0106】図 9 は本発明の実施形態 1、2 の画像処理システムの処理の概要を示すフローチャートである。まず、デジタルカメラ側において、ステップ S101 で、記録ヘッドの 1 走査で記録可能な画素数をユーザからの入力あるいはプリンタより獲得する。次に、ステップ S202 で、獲得した画素数に応じて画像データを分割する。次に、分割された画像データを J P E G 圧縮しデータ記録部 26 に記録する。

【0107】プリンタ側において、ステップ S104 で、出力させる画像データの選択、画像サイズの設定をインタフェース部 31（あるいはインタフェース部 81）によって入力する。ステップ S105 で、インタフェース部 31（あるいはインタフェース部 81）からの入力に応じて、デジタルカメラより J P E G 圧縮された画像データを入力する。ステップ S106 で、入力された J P E G 圧縮された画像データを J P E G 解凍する。ステップ S107 で、J P E G 解凍された画像データに対し、必要な画像処理を施した後、プリンタエンジン 37（あるいはプリンタエンジン 88）によって記録する。

【0108】次に、実施形態 3 における画像処理システムで実行される処理の概要について、図 10 を用いて説明する。図 10 は本発明の実施形態 3 の画像処理システムの処理の概要を示すフローチャートである。まず、デジタルカメラ側において、ステップ S201 で、予め決定されている画像データの分割単位である所定の画素数に応じて画像データを分割する。次に、ステップ S202 で、分割された画像データを J P E G 圧縮しデータ記録部 26 に記録する。

【0109】プリンタ側において、ステップ S203 で、プリンタより画像データの分割単位である所定の画素数を示す情報を入力する。ステップ S204 で、入力された所定の画素数とプリンタの記録ヘッドの 1 走査で記録可能な画素数を比較する。ステップ S205 で、比較結果に基づいて、デジタルカメラより J P E G 圧縮された画像データを入力する。ステップ S206 で、入力された J P E G 圧縮された画像データを J P E G 解凍する。ステップ S207 で、J P E G 解凍された画像データに対し、必要な画像処理を施した後、プリンタエンジン

ン 88 によって記録する。

【0110】以上説明したように、実施形態 1～実施形態 3 によれば、デジタルカメラ内で部分分割された画像の J P E G 圧縮された画像データを、必要となる画像データ分だけプリンタへ転送するため、転送の時間を短縮することができる。また、プリンタの記録ヘッドの 1 走査で記録可能な画素数毎に画像データを受信し記録するので、従来に比べて大きくバッファメモリの記憶容量を低減することが可能となる。本発明の実施形態において、出力装置の画像データの出力単位を示す出力単位情報を得るに際しては、図 22 に示すアシンクロナスパケットの通信を行うことによって得れば良い。また、かかる出力単位情報に基づいて、入力された画像データを圧縮するに際しては、かかる画像データを図 22 に示すアイソクロナスパケットで受信しても良いし、アシンクロナスパケットで受信するのは、受信速度の点で好ましい。また、アシンクロナスパケットで受信するのは、受信データの確実性の点で好ましい。また、本実施形態では、I E E E 1394 シリアルバスを例に挙げて説明したが、本発明はこれに限定されず、他のインタフェース、例えば、U S B と呼ばれるインタフェースでも良いし、また、それ以外の方式のインタフェースでも良い。

【0111】尚、本発明は、複数の機器（例えば、ホストコンピュータ、インタフェース機器、リーダ、プリンタ等）から構成されるシステムに適用しても、一つの機器からなる装置（例えば、複写機、ファクシミリ装置等）に適用してもよい。また、本発明の目的は、前述した実施形態の機能を実現するソフトウェアのプログラムコードを記録した記憶媒体を、システムあるいは装置に供給し、そのシステムあるいは装置のコンピュータ（または C P U や M P U）が記憶媒体に格納されたプログラムコードを読み出し実行することによっても、達成されることは言うまでもない。

【0112】この場合、記憶媒体から読出されたプログラムコード自体が上述した実施の形態の機能を実現することになり、そのプログラムコードを記憶した記憶媒体は本発明を構成することになる。プログラムコードを供給するための記憶媒体としては、例えば、フロッピディスク、ハードディスク、光ディスク、光磁気ディスク、C D - R O M、C D - R、磁気テープ、不揮発性のメモリカード、ROMなどを用いることができる。

【0113】また、コンピュータが読出したプログラムコードを実行することにより、前述した実施形態の機能が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼働している O S（オペレーティングシステム）などが実際の処理の一部または全部を行い、その処理によって前述した実施の形態の機能が実現される場合も含まれることは言うまでもない。更に、記憶媒体から読出されたプログラムコードが、コン

ピュータに挿入された機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに書き込まれた後、そのプログラムコードの指示に基づき、その機能拡張ボードや機能拡張ユニットに備わるCPUなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

#### 【0114】

【発明の効果】以上説明したように、本発明によれば、コストを上げることなく、トータルスループットを向上10 することができる画像処理装置及びその制御方法、画像処理システム、出力装置、記憶媒体を提供できる。

#### 【図面の簡単な説明】

【図1】本発明のプリンタの記録動作を説明するための図である。

【図2】本発明の実施形態1のデジタルカメラの機能構成を示すブロック図である。

【図3】本発明の実施形態1のプリンタの機能構成を示すブロック図である。

【図4】本発明の実施形態1のデジタルカメラとプリンタで構成される画像処理システムの構成を示す図である。20

【図5】本発明の実施形態1のデジタルカメラとパーソナルコンピュータで構成される画像処理システムの構成を示す図である。

【図6】本発明の実施形態1のプリンタの記録例を説明するための図である。

【図7】本発明の実施形態1のプリンタの記録動作を説明するための図である。

【図8】本発明の実施形態2のプリンタの機能構成を示すブロック図である。30

【図9】本発明の実施形態1、2の画像処理システムの処理の概要を示すフローチャートである。

【図10】本発明の実施形態3の画像処理システムの処理の概要を示すフローチャートである。

【図11】IEEE1394シリアルバスを用いた通信システムの一実施形態を示す図である。

【図12】IEEE1394シリアルバスの階層構造を示す図である。

【図13】IEEE1394シリアルバスのアドレスを示す図である。40

【図14】IEEE1394シリアルバスの断面図である。

【図15】DSL i n k符号化方式を説明するための図である。

【図16】ノード間の親子関係を示す図である。

【図17】アービトレーションの過程を示す図である。

【図18】Asynchronous転送におけるサブアクションを示す図である。

【図19】Asynchronous転送におけるパケット構造を示す図である。

【図20】Isochronous転送におけるサブアクションを示す図である。

【図21】Isochronous転送におけるパケット構造を示す図である。

【図22】IEEE1394シリアルバスの通信サイクルの一例を示す図である。

【図23】バスリセットからIDの設定までを説明するためのフローチャートである。

【図24】ルートの決定方法を説明するフローチャートである。

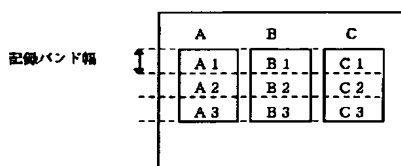
【図25】親子関係決定からすべてのノードIDの設定までの手順を説明するフローチャートである。

【図26】アービトレーションの過程を示すフローチャートである。

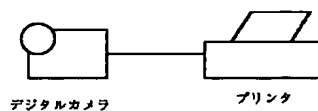
#### 【符号の説明】

- 21 レンズ
- 22 CCD素子
- 23 A/D変換部
- 24 画像処理部
- 25 画像変換部
- 26 データ記録部
- 27、31、81 インタフェース部
- 32、82 J P E G解凍部
- 33、84 プリント画像処理部
- 34、85 記録位置制御処理部
- 35、86 ヘッド駆動信号変換部
- 36 バッファメモリ
- 37、88 プリンタエンジン
- 83 バッファメモリ1
- 87 バッファメモリ2

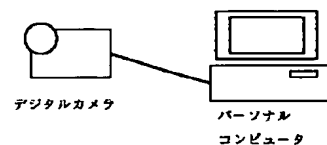
【図1】



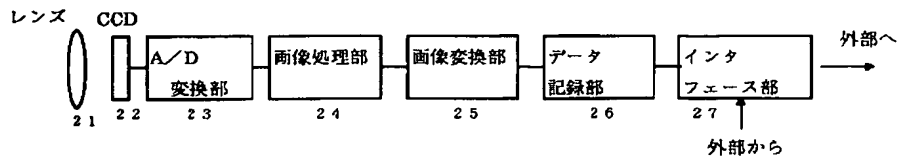
【図4】



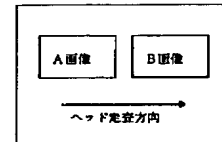
【図5】



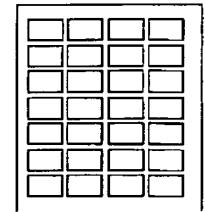
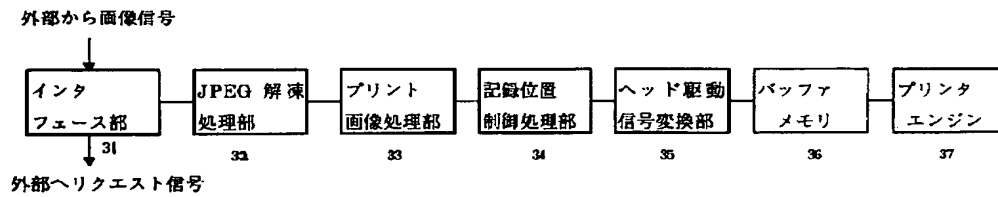
【図2】



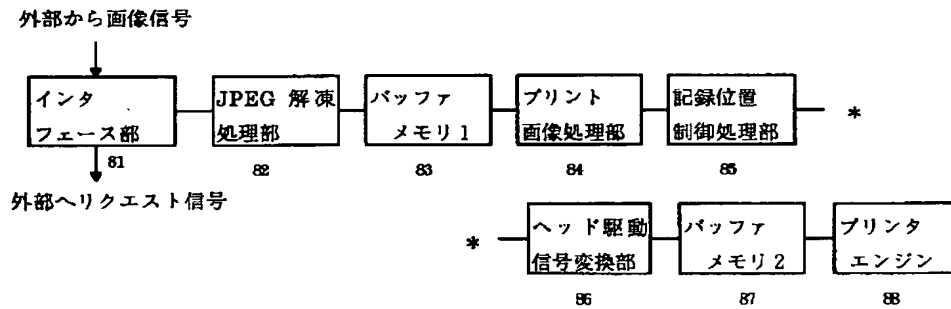
【図6】



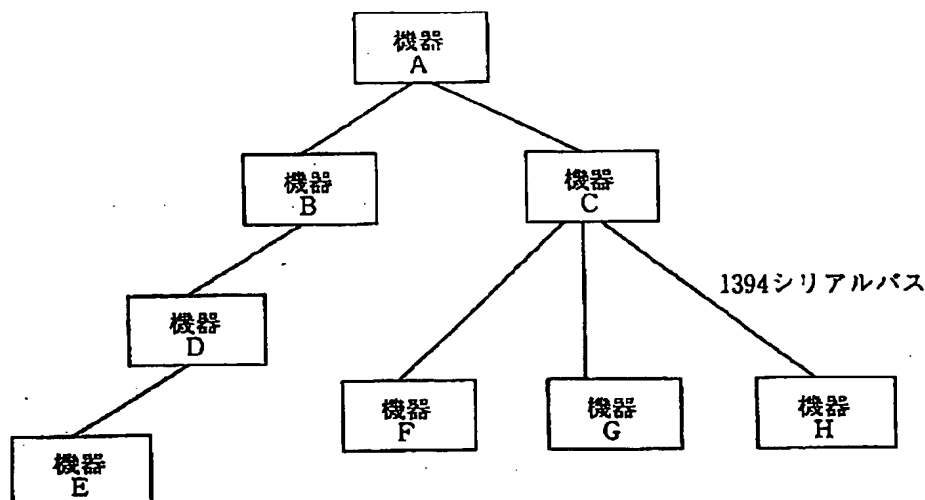
【図3】



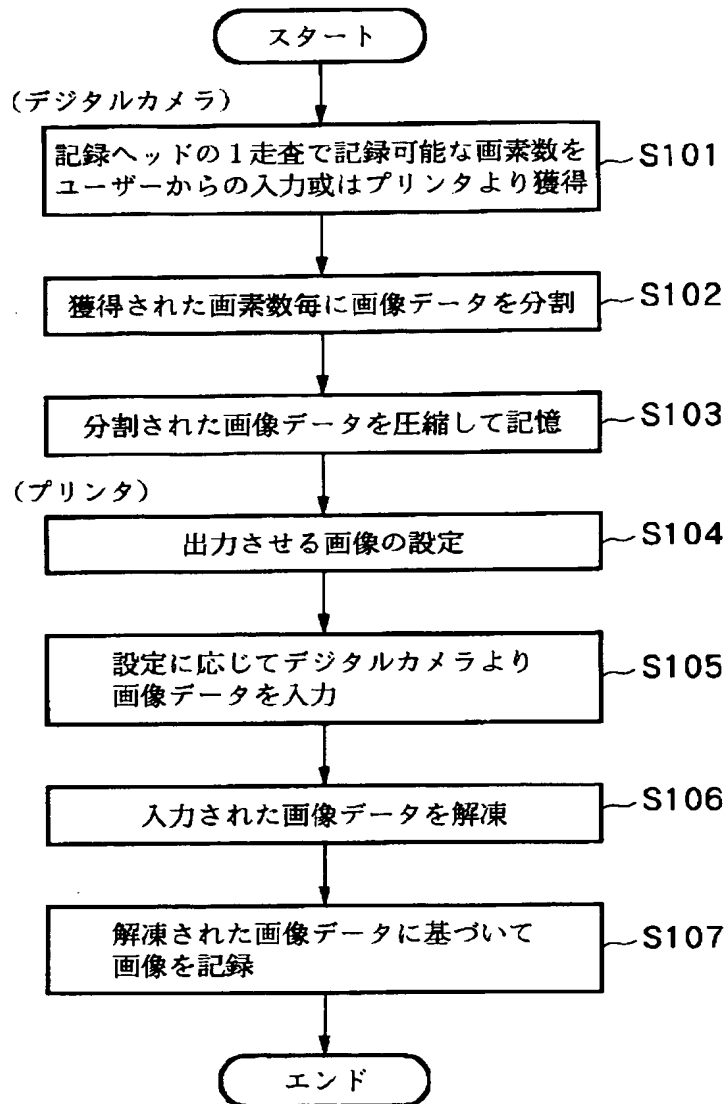
【図8】



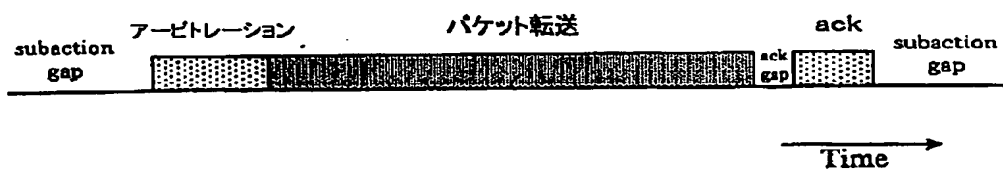
【図11】



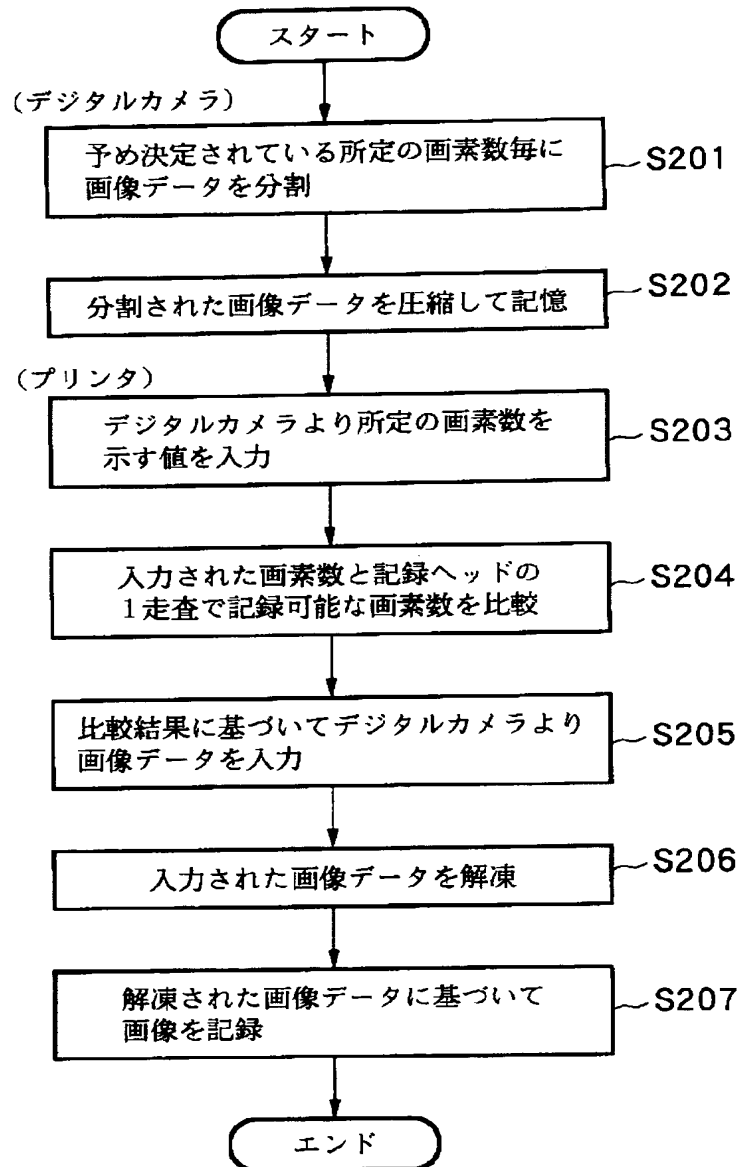
【図9】



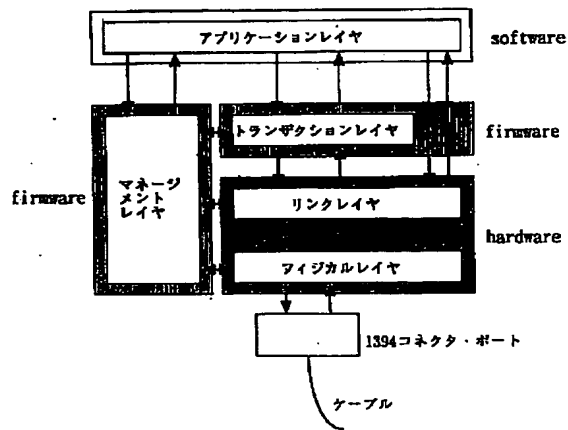
【図18】



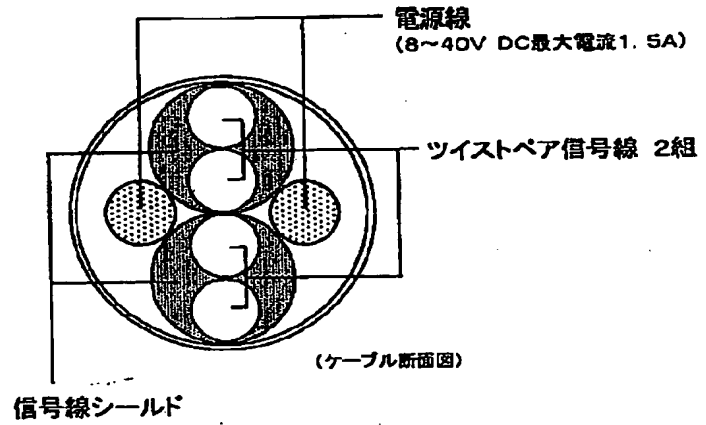
【図10】



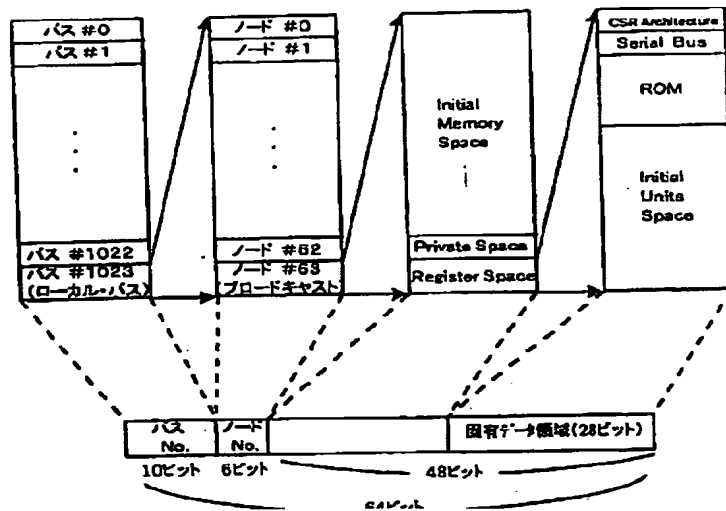
【図12】



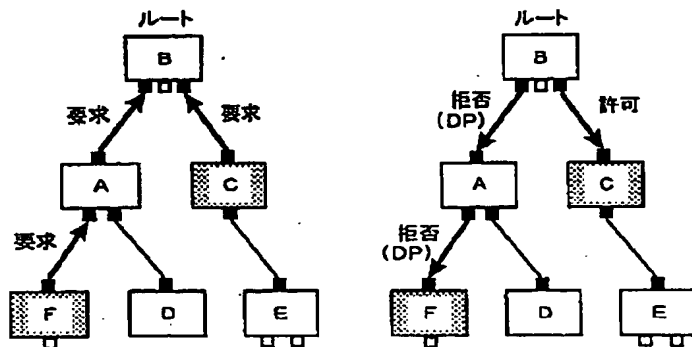
【図14】



【図13】



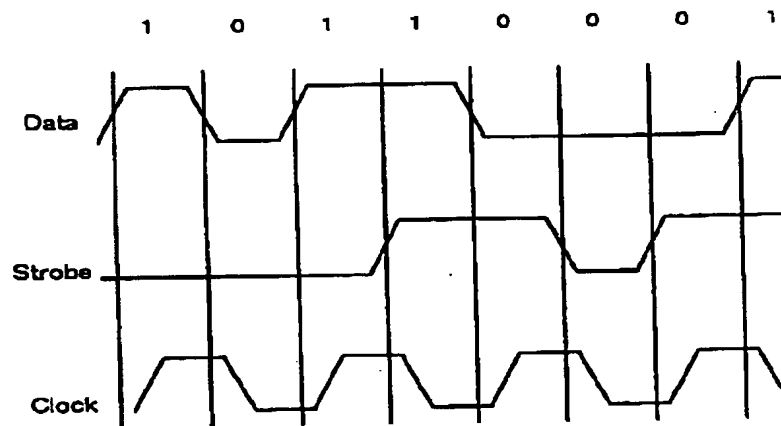
【図17】



(a) バス使用権の要求

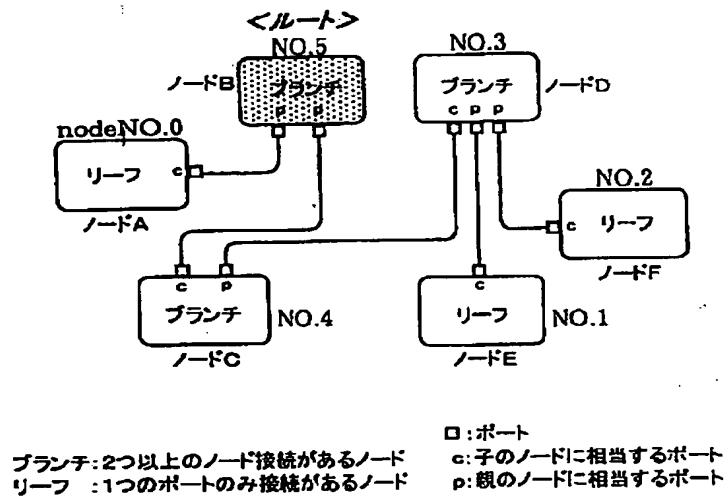
(b) バス使用の許可

【図15】

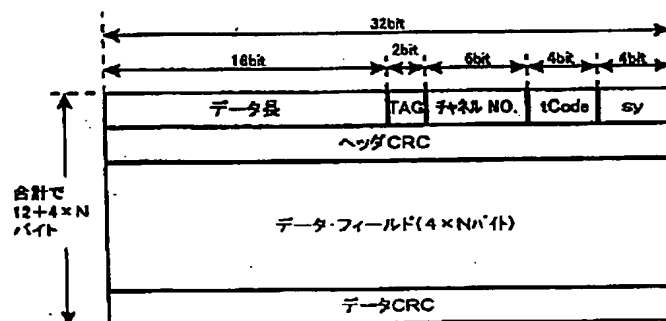


(DataとStrobeの排他的論理和信号)

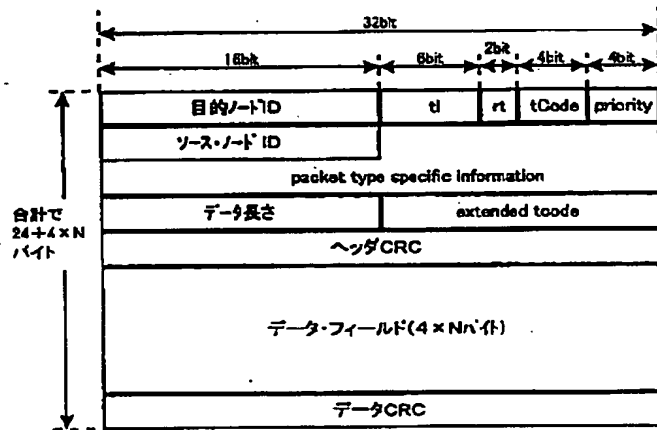
【図16】



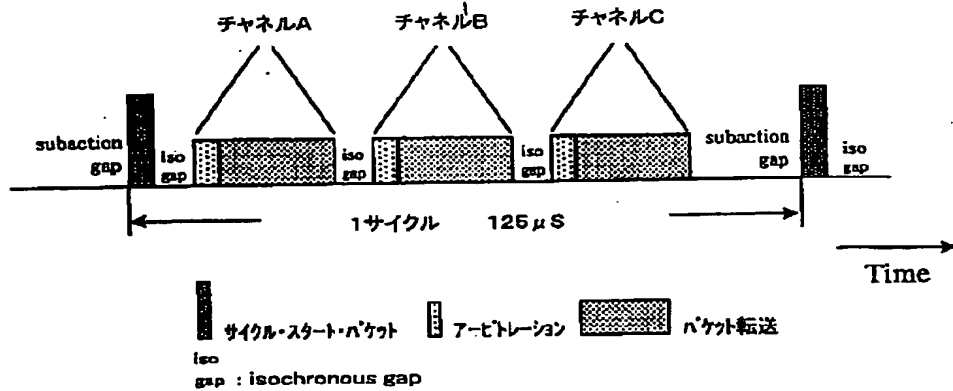
【図21】



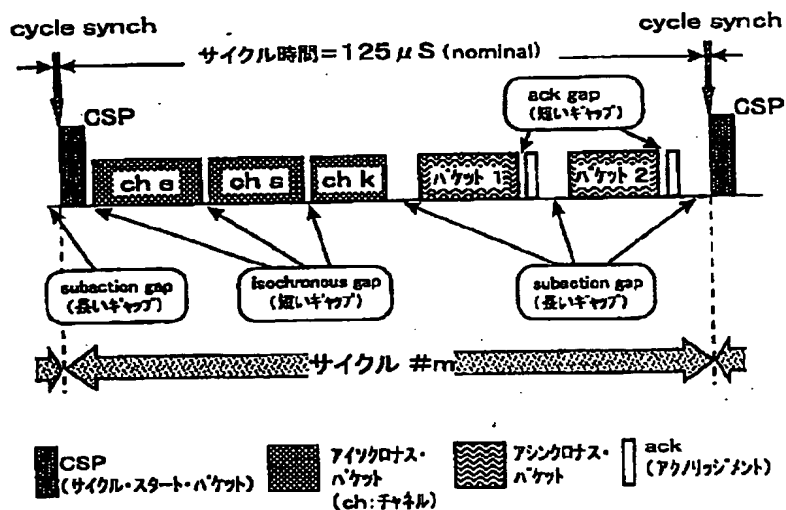
【図19】



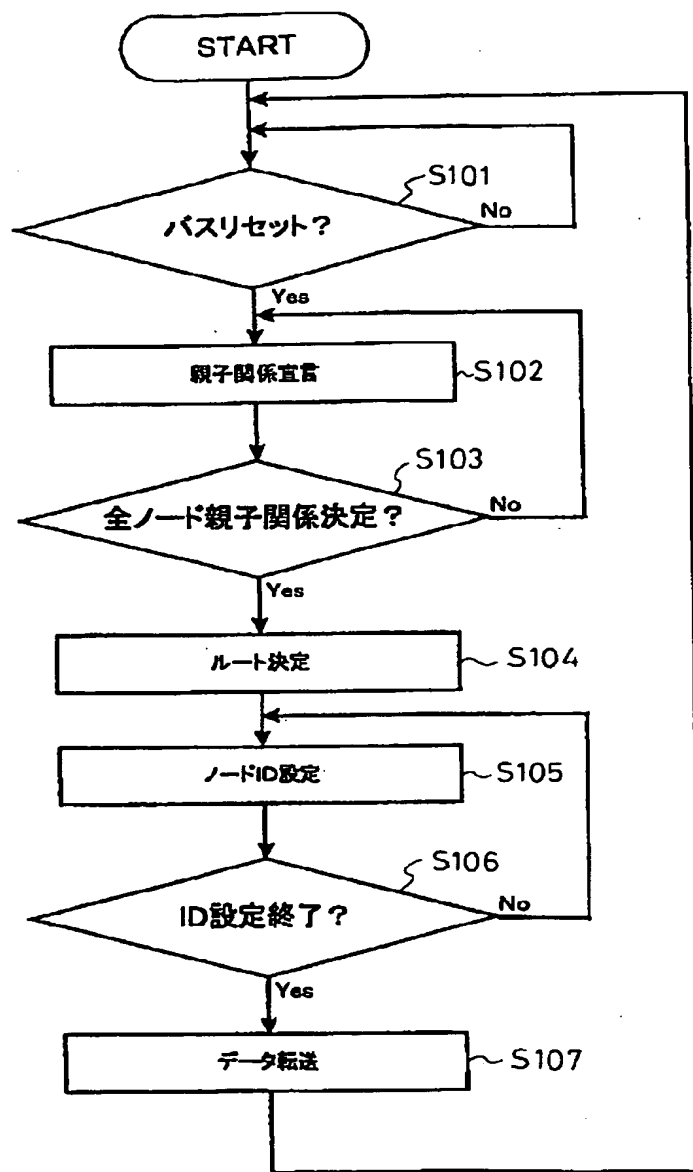
【図20】



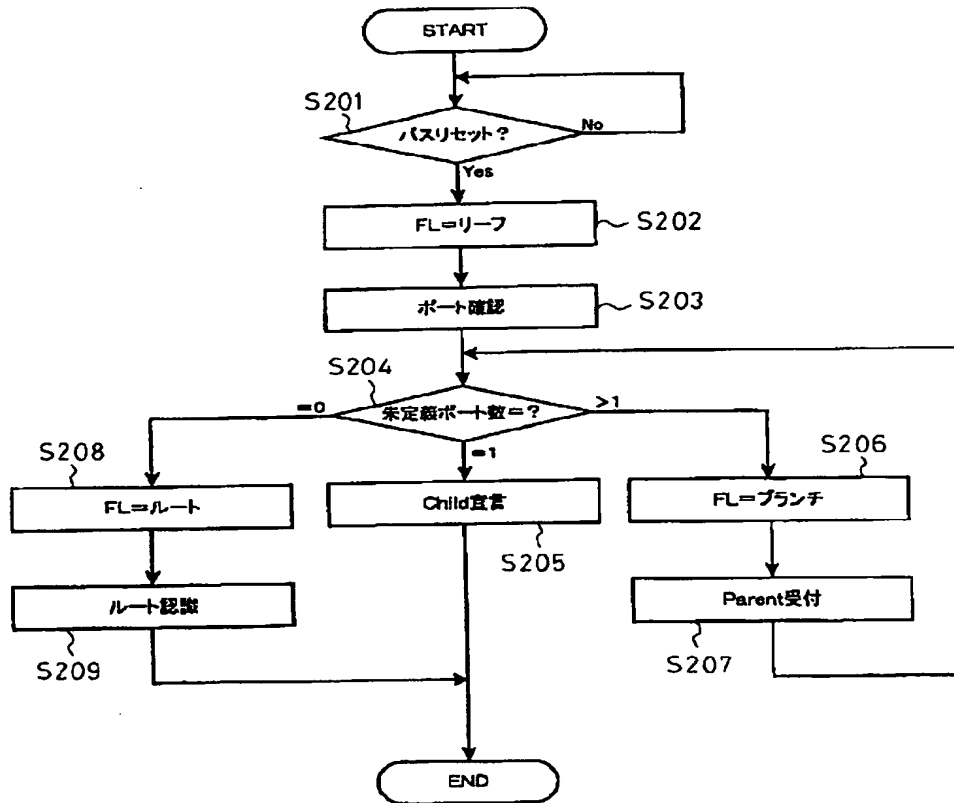
【図22】



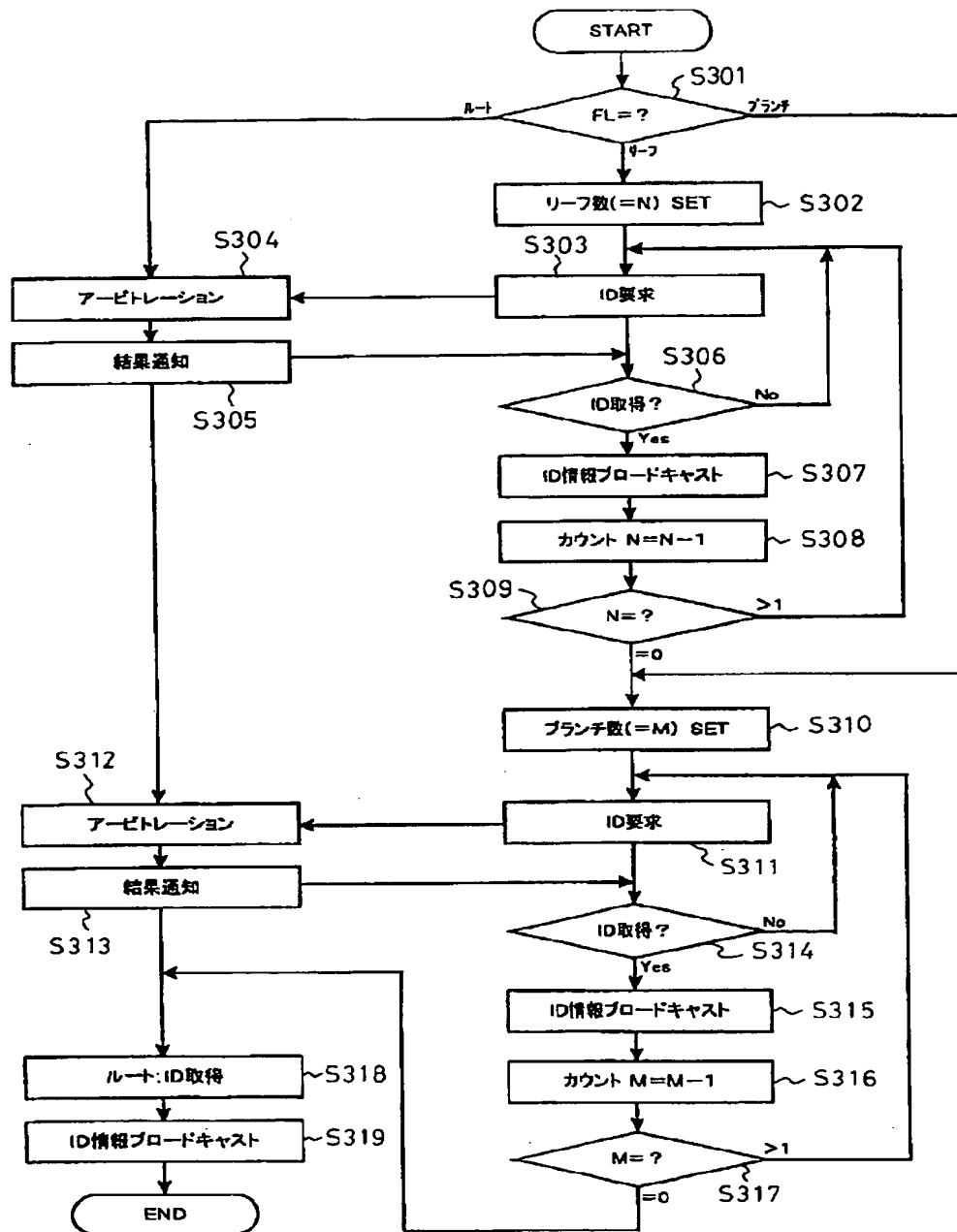
【図23】



【図24】



【図25】



【図26】

